THE IDENTIFICATION AND CONTROL OF HEALTH HAZARDS FOR HOSPITAL WORKERS

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The views expressed in this report do not necessarily represent those of Alberta Workers' Health, Safety and Compensation.

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After the completion of this report, I became aware of a Teaching Manual (and a video film) regarding Hazards for Hospital Workers that is being prepared by the Alberta Federation of Labour (AFL). The AFL project is directed primarily to health care workers, and my project is directed primarily to the providers of occupational health services to hospital workers. I anticipate that the two documents are complimentary, and I hope that together they will help to protect the health and safety of hospital workers in Alberta.

PREFACE

The primary purpose of this report is to organize the information regarding health hazards for workers in a hospital setting. It provides a reference for those individuals who have either an interest or direct responsibility for recognition, evaluation, and control of health hazards found in hospitals.

Section One, the introductory section, touches on the need for occupational health services for hospital workers. In this section, there are recommendations for components of basic health evaluation and medical assessment of workers.

Section Two of the report deals with the health hazards according to department and makes recommendations for specific medical monitoring if appropriate.

Section Three discusses specific hazards, their control and medical monitoring recommendations in greater detail. Each section concludes with references for recommended books, films, videos or pamphlets.

Several flow sheets have been included to assist the readers in better understanding the subject matter.

Finally, the looseleaf format has been chosen to facilitate periodic revision, as the state of knowledge in this, as in any subject, is not static. This format will also enable the addition of sections which a hospital feels are relevant to its needs and facilitate information exchange with other hospitals.

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INTRODUCTION

Hospital workers may be exposed to a variety of potential health hazards such as lasers, x-rays, radioactive isotopes, drugs, chemicals, needles, bacteria and viruses in addition to physical and emotional stresses. A hospital occupational health service strives to promote worker health in the hospital workplace.

Successful hospital occupational health and safety programs have several common elements:

1. Enthusiastic commitment and fiscal support from the all levels of management.

2. Precise knowledge of the workplace hazards and the ability to modify them and provide proper medical and environmental surveillance.

3. Effective health and safety education at the time of hire and then periodically during employment.

4. Reliable data about accidents and illnesses to indicate trouble spots is collected in a statistically useful manner.

5. A committed safety committee with broad representation from the workforce and management.

6. Co-ordination of personal and occupational health programs demonstrating an awareness of interaction of worker lifestyle, health and work.

7. Input into building and equipment plans.

8. The Occupational Health Service maintains impartiality in relationships with employer and worker. Confidentiality of health information is maintained.

NOISE, VENTILATION AND LIGHTING:

Noise, ventilation and lighting in hospitals are important topics which deserve attention beyond the scope of this report. In these three areas, many of the principles which industry in general have developed can be adapted to the hospital setting. There are audiologists, noise control engineers, occupational hygienists, ventilation engineers and lighting engineers or specialists who can assist in these areas.

OCCUPATIONAL HEALTH SERVICE

Health Evaluation and Medical Assessment:

Employment should begin with a good baseline health assessment. The preplacement evaluation focuses on the candidate's ability to perform safely in his work setting. Many hazards discussed in Section Two and Three of this report have specific medical surveillance recommendations. The evaluation permits the physician to identify health problems which might affect an individuals ability to do a specific job and can assist the candidate by identifying health problems which may require special preventive and protective measures on the job. It also provides the Staff Health personnel with an opportunity to teach health protection and promotion principles.

To protect the worker and patients, each worker's immunization status must be up to date. See page 3-56 for a listing of recommended immunizations. All workers should have a rubella antibody titer established and immunization is given (with written consent) to those who are susceptible. This should be done for male as well as female staff. For those in high risk areas, a blood test is available to establish Hepatitis B status. Presently, Hepatitis B vaccine is often given to workers who are employed in areas of high risk for this disease.

Food handlers should be given specific tests if indicated by health or work history or by recent travel outside North America (Dietary Department, page 2-5).

Because of the prevelance of back injuries in hospitals, a back assessment at the time of preplacement is recommended. Back health is considered to be related to general fitness levels. The Fitness Canada, National Back Fitness Test, sets out some suggestions for a general physical fitness evaluation and some exercises to assess specifically the strength of back, abdominal and thigh muscles. This is a good opportunity for health teaching and for encouraging workers to become more fit and to strengthen the muscles supporting the back (see Back Care in Section Three of this report). However, fitness should be encouraged in all workers.

Skin condition must be evaluated. Dermatitis is a common problem caused by one of the many substances or chemicals present in the workplace or home. Such skin conditions also provide an entry point for infections.

Other tests may include vision, mantoux (where positive, also a chest x-ray - see T.B., page 3-67), urinalysis, blood pressure, blood chemistry, possibly specific to the areas of employment, such as for Radiology (see page 2-43). Other tests, depending on the area of work and symptoms, are audiometry and ECG. Anyone who is exposed to excessive noise must have his hearing monitored.

Preplacement and periodic health evaluations contain essentially the same elements. The periodic health evaluation serves to uncover any new health problems and is a vehicle for health teaching, including developing an awareness of potential health hazard at the worker's place of work.

All workers should be made aware of the health services available to them at the hospital. Included in the occupational health service should be programs to assist workers in dealing with stress, drug or alcohol addiction and other personal problems (Employee Assistance Program, page 3-115).

Staff Needed

The size of staff will depend on a number of workers, the type of service and the size of the institution. The Director of the Occupational Health Service assumes the duties and management responsibilities of a department head, should provide input to policy making level of management, and have access to the Chief Executive Officer. A physician, if full time, or a nurse would normally be expected to occupy this position.

The Director must be in a position to advise on and write policies and procedures, develop job descriptions, present budgets and be an effective communicator. The director must be able to work with both union and management, advise on relevant legislation and be able to design or adapt the occupational health service to meet the needs of the institution.

Physician:

Physician(s) should be employed in the Occupational Health Service Department on a part time or full time basis, depending on the needs of the institution. As well as being licensed to practice medicine in Alberta, the physician should be knowledgeable in the practice and principles of Occupational medicine. To ensure continuity, it is recommended that this be a permanent position. The physician is primarily concerned with the worker's medical fitness for the job, identification of job related health hazards and planning preventive measures and programs. The physician acts as a liason between the Hospital Health Service and the personal physician of the worker when health problems arise with respect to work.

Nurses:

The number of nurses employed depends on the size of hospital and scope of service. The nurse should be registered with the Alberta Association of Nurses and preferably also be a graduate of a recognized Occupational Health Nursing Certificate Program.

The nurse must have a knowledge of work procedures, and a working knowledge of hospital health hazards. (S)he should be able to perform basic environmental surveys or walk-throughs; should be knowledgeable about chemical exposures and hazards; and must be able to understand and interpret monitoring results. Knowledge of accident prevention and infection control is an important aspect of working in Staff Health or Occupational Health Departments in a hospital. The nurse will probably sit on several committees such as accident prevention, infection control, and in-service education.

Recommended Numbers of Staff:

The Ontario Hospital Association recommends one and a half hours of physician time per week per 100 workers, and two hours of nurse time per day per 100 workers, up to six hours when a full-time nurse should be employed. In the U.S. Policy Service Guide, Howe recommended that a hospital health service employ one physician per 2000 workers and one nurse up to 500 workers. (Alberta First Aid Regulation requires one nurse for companies employing more than 200 workers on a shift).

Secretarial staff should be provided to assist with the record keeping and other clerical work required in an occupational health program.

Location and Size of the Health Service

The occupational health centre should be a self-contained unit but not be away from the mainstream of hospital activity. The size according to Howe (p.61) should be one square foot per worker up to a maximum of 500 square feet (40 M^2). This space should be divided into an examining room, treatment room, waiting area, quiet/rest room, washroom, an office which allows privacy for counselling, and an area for secure storage of records.

Specialists such as occupational hygienists, toxicologists and ventilation engineers may need to be consulted from time to time.

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SECTION TWO

HEALTH HAZARDS BY DEPARTMENT

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INTRODUCTION

Potential health and safety hazards can be found in all parts of the hospital.

Trips, falls or knocking against objects can happen anywhere, but the possibilities are increased in departments where grease or water is often spilled, such as kitchens or laundries. Other common hazards include loose telephone wires, open drawers, glass doors or doors that open without warning.

Inadequate or poorly balanced ventiliation systems can be a source of discomfort. An adequate ventilation system is essential if there are smokers, or machines that produce dust or fumes. The potential to spread infection exists in systems which are not properly cleaned and maintained. All hospital staff to some degree will have contact with ill, frightened, dying, worried or hostile people. Jobs that have deadlines, shift work, rapid advances in technology or the possibility that mistakes can have serious or fatal effects on people are also common in the hospital setting. This can create emotional stress which can be severe depending on the resources available to assist the worker to deal with it.

As the above factors are to be found to some extent in all hospital departments, they will not be mentioned as hazards in the section that follows, but nevertheless they should be borne in mind when considering potential hazards for a specific department.

All new staff should be made familiar with the staff health service and encouraged to use the facilities for the early detection of health problems and for health promotion. It is essential that staff are properly oriented to new departments, are aware of any special hazards present and instructed in methods to protect themselves.

HEALTH HAZARDS BY DEPARTMENT

I. CENTRAL SUPPLY SERVICES

A. Health Hazard

Potential exposure to ethylene oxide (Ethylene Oxide, page 3-40).

Dermatitis from chemicals, cleaning agents or antiseptics.

Cuts or punctures from improperly disposed of *"sharps"* (Sharps, page 3-105).

Infection from contaminated equipment (Infection, page 3-50).

Burns from autoclave or hot materials from autoclave.

Electrical shocks from equipment.

Muscle or back strain. (Back Care, page 3-11)

B. Medical Surveillance

In addition to the preplacement and periodic medical evaluation discussed in Section One, see medical surveillance following the topic, Ethylene Oxide, in Section Three.

II. CLERICAL

A. Health Hazards

Chronic fatigue, back/neck pain due to sitting and writing for long periods of time, or sitting at a video display terminal (V.D.T.). (VDT's, page 3-119)

Muscle and back strain from lifting (Back Care, page 3-11).

Eye strain from reading in improper light or using V.D.T.'s in reflecting light.

Dermatoses from adhesives, carbon paper, duplicating fluid or materials, ink remover, solvent type cleaner, typewriter ribbons. (Chemical Hazards, page 3-19; Dermatitis, page 3-36)

Mental stress and fatigue due to work load or working in small, enclosed (windowless) areas. (Stress, page 3-108).

Medical secretaries are frequently in close relationship with patients in the Out-Patient Department; and are, therefore, exposed to infections.

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III. DIETARY DEPARTMENT

The hazards listed have an effect on the worker in the dietary department, but they will also have either a direct or indirect effect on any consumer of hospital prepared food. Many hospital workers will eat at least one meal per working day at the hospital.

A. Health Hazards

Improperly prepared, stored or transported food can be a source of infection for all. Or if the food has lost its nutrient value, it cannot support or promote good health as it is intended.

Improperly cleaned and sanitized utensils may lead to contaminated food.

Lack of effective separation of food and cleaning compounds could potentially lead to ingestion of non-food materials.

The kitchen worker who is a disease carrier can spread his infection to other workers and patients.

Those dietary workers with direct patient contact risk contracting patient infections.

Dermatitis due to bacterial or chemical contact may be secondary to the frequent handwashing necessary in the Dietary Department (Dermatitis, page 3-36).

The following should be considered when deciding which factors have the potential to cause accidents in the kitchen environment.

The primary hazard of cuts or abrasions from the many sharp kitchen implements or broken dishes can lead to the secondary hazard of infection. (Sharps, page 3-105; Infection, page 3-50)

Accumulated garbage can be both a tripping hazard and a source of infection. (Waste Management, page 3-123; Infection, page 3-50)

Clothing or fingers caught in moving parts of machinery with insufficient guarding, or due to lack of safety training and awareness.

Muscle or back strains through lifting, carrying or over-exertion. (Back Care, page 3-11)

Burns through badly designed oven doors or inadequate protection from grease spills, splatters, hot water or steam.

Inappropriate lighting, too little or too bright with shadows or reflections can cause accidents and headaches.

Electrical hazards through improperly grounded equipment, worn wires or inappropriate proximity of electricity, water and steam. Equipment must have a proper plan of maintenance and the worker must be protected from shocks.

Excessive noise from kitchen equipment and machinery is rarely a hearing hazard, but it is stressful and impairs communication in the kitchen.

Fire or explosions due to grease or other potentially flammable materials.

Heat and increased humidity may predispose the worker to accidents as well as illness (Heat, page 3-45).

Less common conditions include:

Increased carbon dioxide or nitrogen proportionate to oxygen levels in the atmosphere due to escape of cryogenic gases from a badly designed tunnel freezer.

Malfunctioning doors on the walk-in freezers have been known to trap workers inside, with the resulting risk of cold exposure and anoxia.

B. Medical Monitoring

New dietary staff should have a preplacement health evaluation including updating of immunizations as necessary (Immunization Schedule, page 3-56). Immunization must be maintained. The importance of good personal hygiene and frequent hand washing should be emphasised.

It is felt that the greatest risk presented by a food handler comes from the transfer of infection either by droplets or skin contact. Therefore, in addition to a chest x-ray, the skin and throat of the applicant should be carefully examined. If suspicious lesions are observed in either area, further investigation is in order. Because of the prevalence of dermatitis, skin must be observed during any medical contacts.

Routine screening for enteric infection is no longer done. It is not felt to be cost effective or able to produce consistently meaningful results. Illness in the early stages may be observed only by the individual, therefore, a policy with which the worker will comply with confidence needs to be in place for early prevention. (S)he must be taught that the most important symptoms are vomiting, diarrhea, heartburn and abnormalities of bowel action and of stools. (S)he then needs to feel confident about the service available, and report these symptoms to the supervisor and to the occupational health service. The importance of personal hygiene cannot be over stated. Any cuts or wounds must be covered with a waterproof dressing, any skin infections must be covered and medically treated.

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IV. HOUSEKEEPING

Good housekeeping affects the whole hospital environment and impacts directly not only on the health and safety of the housekeeper but also on everyone else in the hospital.

A. Health Hazards:

Dermatitis or chemical burns from agents used for cleaning. (Dermatitis, page 3-36; Chemical Hazards, page 3-19)

Respiratory irritation due to inhalation of chemical agents, or dust and fumes dispersed into the air while cleaning. (Chemical Hazards, page 3-19)

Skin or respiratory irritation, occurring while cleaning up spilled chemicals or mercury from broken thermometers or blood pressure machines.

Infection hazard from improperly disposed of utensils or linen. Inadequate instruction may be given for handling potential or known infective situations.

Cuts or abrasions following inadequate "sharps" disposal. Infection may be secondary hazard. (Sharps, page 3-105)

Shock from electrical equipment (housekeeping equipment often uses water with electricity).

B. Medical Monitoring

Particular attention should be paid to back health and skin integrity during preplacement and periodic health evaluations.

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V. LABORATORY

The variety, size, type and complexity of scientific laboratories make simple generalizations on the health and safety of laboratory workers difficult. Because specialized education, knowledge and skills are so important for the job, health and safety attitudes can become secondary.

The biomedical laboratories represent a particular risk for worker infection because of the nature of the work, and the exposure to a greater concentration of infectious agents than is present in other work areas.

A. Health Hazards

Risk of infection from patient contact or from exposure to specimens or cultures. (Infection, page 3-50)

Ingested pathogens or chemicals during pipette mishaps.

Injected pathogens after injury with sharp lancettes, needles or broken glass. (Infections, page 3-50; Sharps, page 3-105)

Exposure by skin contact or eye splashes to a variety of chemicals which may be toxic, corrosive, flammable or explosive. (Chemical Hazards, page 3-19)

Potential for non-ionizing radiation from a variety of instruments, e.g. blood warmer. (Non-Ionizing Radiation, page 3-86)

Potential for ionizing radiation if working in the nuclear medicine laboratory. (Nuclear Medicine, page 3-80)

Possibility of shocks from electrical apparatus.

Burns during sample testing procedures, e.g. the bunsen burner.

Slips on spills, tripping over or falling against equipment.

Becoming caught in moving parts or machinery such as a centrifuge.

Stress if understaffed and a variety of procedures to be accomplished in a short time, especially while "on-call". (Stress, page 3-108)

B. Medical Monitoring

Monitoring should be appropriate to chemicals, material and procedures contacted during work, there must be an awareness of the specific worksite on the part of the worker and the person conducting the medical examination. Laboratory workers must be fully immunized with more stringent than usual protection, as they are in early contact with the more unusual and possibly undiagnosed diseases which arrive in a hospital to be treated. (Immunization Schedule, page 3-56)

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VI. LAUNDRY

A. Health Hazards

Heat and increased humidity may predispose the worker to accidents as well as illness such as heat cramps or exhaustion. (Heat, page 3-45)

Dermatitis from chemical, contact with contaminated laundry, or with the agents used to wash them. (Dermatitis, page 3-36, Chemical Hazards, page 3-19)

Hearing problems from excessively noisy machinery.

Chemicals used to clean the equipment can also be a hazard. (Chemical Hazards, page 3-19)

Infection from contaminated linen which is improperly labeled or handled. Discarded soiled linen must be garbaged or removed immediately so the linen cannot be a further source of contamination or allow bacteria to develop. The washing machines should have sufficient capacity to avoid excessive accumulation of soiled linen.

Accidents may be caused by the clothing or fingers of the worker becoming caught in moving parts of machinery if there is insufficient guarding or if safety instructions are disregarded.

Muscle or back strain through lifting, carrying or over exertion. (Back Care, page 3-11)

Burns from hot equipment, water or laundry.

Electrical hazards through improperly grounded equipment, worn wires, or inappropriate proximity of electricity and water.

B. Medical Monitoring

Special attention should be given to skin disorders, including observing for development of skin problems among those workers exposed to hot water, soap and detergent. Workers' immunization should be current according to recommended Public Health Standards. (Immunization Schedule, page 3-56)

References

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VII. **MAINTENANCE** (including heating, engineering and electrical)

Maintenance has been defined as the work carried out in order to keep or restore every facility of an enterprise to an acceptable standard, including the site, the building and contents. Hospitals, like all industrial institutions require maintenance programs developed specifically to meet their needs.

Maintenance workers have health and safety hazards similar to heating engineers, and electricians, and indeed to industry in general. These are exposure to electrical hazards, heat, cold, noise, vibrations and chemicals. There has been much written about the safety aspects of these hazards in industry in general, which could be applied to the hospital setting.

Boiler maintenance can involve entry to confined spaces and use of various chemicals, some of which could be both a skin and inhalent hazard. By knowing the chemicals to be used and their properties, it is then possible to have specific personal protection equipment available. Training in specific work procedures must be given for all known or potential hazards, e.g. entry into confined spaces or removal of old asbestos.

Otherwise, the similarities determine that this group of workers be grouped together with regard to safety and health hazards.

A. Health Hazards

Accidents to maintenance workers are relatively frequent due to unnecessary risks to save time or from the lack of "safe system of work".

Exposure to chemicals; among others, degreasers, cleaning and scouring agents (for deposits in boilers), chlorination of therapy pools,may cause burns, dermatitis or systemic poisoning. (Chemical Hazards, page 3-19, Dermatitis, page 3-36)

Entry to confined spaces is required for boiler maintenance. There is the potential for contacting chemical inhalents or skin irritants. Machinery can accidentally be turned on if not properly locked out.

Danger of explosion if corrosion is not checked in the heating or boiler room engines.

Heat exposure when maintaining equipment in the laundry, kitchen or boiler room. (Heat, page 3-45)

Burns from contact with hot material.

Noise exposure during repairs and maintenance in areas like the laundry, the boiler room or the wood working room.

Cold exposure when working outside in winter or repairing a walk-in freezer.

Electrical shock risk when checking, repairing or installing hospital electrical equipment and by failing to use lock-out procedures.

Injuries from a malfunctioning guard on machines under repair or from her/his own equipment, for example, a saw.

Falls from unsafe access positions or against obstructions.

Eye injuries, especially when sawing, grinding, welding, cutting, chopping or scaling without suitable eye protection.

Strains or back injuries when lifting or carrying. (Back Care, page 3-11)

Infection, including tetanus acquired during maintenance and gardening procedures. (Infection, page 3-50)

Compressed air injuries from incorrect handling of air lines.

B. Preplacement and Periodic Health Assessments

During medicals, a careful skin examination should be included because dermatitis is common in most hospital occupations. Specific tests or examinations may need to be done if indicated by the new worker's occupational or medical history or in preparation for a hazard (s)he may be facing in his/her new job. Immunization should be updated as necessary to meet recommended standards. Because noisy areas are frequently entered, an audiometric assessment is recommended.

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VIII. MEDICAL (Including Medical Students)

A. Health Hazards

Stress is a factor in the work of medical personnel.

Medical students are vulnerable to physical and mental stress because of their close involvement with sickness and death, the need for exacting studies and examinations, long working hours and the need to make crucial decisions. (Stress, page 3-108)

Senior medical staff have the responsibility for the policy of all the more technical and moral problems related to the patient and to the hospital.

Drug addiction from the relatively easy availability of drugs.

Medical personnel are subject to the hazards of the areas they visit and in proportion to the length of time they spend in the particular area. For example - anasthetists in the operating rooms are subject to anaesthetic gas exposure. Infections can be contracted in any part of the hospital. Exposure to cytotoxic drugs can cause problems. (Cytotoxic Drugs, page 3-29)

There is also the danger of injury while using complex medical devices and equipment.

B. Medical Monitoring

A basic medical examination similar to the one outlined in Section One of this report will yield a good baseline health evaluation. The baseline could be used to assist in assessing exposures or factors that have the potential to contribute to illness and to assist workers in maintaining their own health.

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IX. MORTUARY

A. Health Hazard

Risk from diagnosed and undiagnosed infections in the cadaver. (Infection, page 3-50)

Cuts from scalpels or equipment used during autopsies. Infection may follow as a secondary hazard.

Radiation risk from radionuclides not removed after patient death.

Chemical exposure from preservatives or cleaning agents. (Chemical Hazards, page 3-19, Dermatitis, page 3-36)

B. Medical Monitoring

A good basic medical examination as outlined in Section One, and specific tests as indicated by past history or present exposures. Immunization should be kept up-to-date.

X. NURSING

(including Registered Nurses, Nursing Assistants, Nursing Aides, and Orderlies)

A. General Nursing Health Hazards

Stress, both psychological and physical are present in the work of nurses in all parts of the hospital. Many factors contribute to emotional stress. Among these should be considered: caring for sick and dying patients; the need for constant vigilance and decision making; the need to adapt to medical and technical changes. For some people shift work is both a physical and psychological stressor.

Drug addiction can be considered a reaction to stress and facilitated by a relatively convenient supply of medications. (Stress, page 3-108; Employee Assistance Program, page 3-115)

Self-medication made easier by the ready availability of drugs and some training in their use.

Exposure to infectious and parasitic diseases. Nursing staff are in the forefront of patient care, infections are therefore a major health hazard. (Infection, page 3-50)

Certain exotic diseases are more likely when a worker is exposed to body secretions or blood of the infected patient. (AIDS, page 3-58; Hepatitis-B, page 3-61)

Cuts or abrasions from inadequate "sharps" disposal. Infection may follow as a secondary hazard. (Sharps, page 3-105)

Dermatitis and allergic responses to chemical products used as disinfectants or medicaments or preservatives. (Dermatitis, page 3-36)

Dermatitis can also occur from the necessary frequent handwashing, adding to the risk of infection. (Dermatitis, page 3-36).

Exposure to chemicals. The hospital is rich with potentially harmful chemical agents. These can be inhaled, ingested, absorbed or injected (Chemical Hazards, page 3-19).

Ionizing radiation exposure from x-rays or nuclear medicine (Radiation, page 3-74).

Shocks from electrical equipment.

Varicose veins from standing for long hours.

Muscle strain and back injuries from lifting and carrying without considering or without being previously taught appropriate body mechanics (Back Care, page 3-11). Physical fitness reduces the chance of back strain.

Danger of injury while using complex medical devices and equipment.

Injury from violent patients.

Cumulative noise exposure from IMEDS, IVACS, ventilators, compressed oxygen entering via nebulizers that do not contain noise attenuators, loud talking, confused loud patients.

Fire danger in oxygen, in pure oxygen, materials that normally have a low combustion temperature will burn very readily.

Exposure to cytotoxic drugs (Cytotoxic Drugs, page 3-29).

B. Health Hazards for Specific Nursing Areas

Nursing areas share similar hazards but different areas tend to have a greater chance for some of the hazards. As mentioned in Section A., stress is a factor common to all areas. These are summarized in the following sections.

1. Emergency Department:

Risk of injury from a violent patient in a psychotic episode, or from one who has been abusing drugs or alcohol.

Increased risk of stress. Patients can frequently be verbally abusive. It can be stressful helping families and the patient cope with the initial impact of injury or illness. There is a prevailing sense of urgency in this department. (Stress, page 3-108)

2. Geriatrics

Muscle and back strain from frequent lifting and turning. (Back Care, page 3-11)

3. Intensive Care Unit, Cardiac Care Unit

Noise from monitoring equipment may be the source of irritation.

Potential ionizing radiation exposure from portable x-rays. (X-Ray, page 3-77)

4. Operating Room Personnel

Over exposure to ionizing radiation from portable x-rays (X-ray, page 3-77) or in areas of frequent x-ray use such as the Cardiac Catheterization Theatre.

Non-ionizing radiation from lasers and ultra-violet light. (Laser, page 3-86; Ultaviolet Light, page 3-92)

Exposure to chemicals such as propellants of different sprays, scrubbing agents, agents released from surgical procedures like surgical cement and possible decomposition of products of other volatile or gaseous agents. All of this should be removed when ventilation is adequate and positive air pressure is present. (Chemical Hazards, page 3-19)

Renal and hepatic diseases from anesthetic gas exposure; increased incidence of abortion if pregnant female or the male spouse is exposed to anesthetic gases. Some evidence of increased incidence of congenital abnormalities in the offspring of exposed workers, female, or male. (Anaesthetic Agents, page 3-4)

Possibility of reduced mental, motor and sensory responses due to waste and escape anesthetic gases in the room (Anaesthetic Agents, page 3-4).

These last two are also potential exposures for recovery room personnel.

Greater potential for accidents "accidents are caused by speed and demand, and this is true in the operating room more than anywhere else" (ILO Encyclopedia).

Electrical shocks from the specialized equipment.

Fires or explosions from the ignition of flammable products in contact with oxygen.

Burns from the autoclave used for flash sterilizing.

Possibility of infections from patients with known or unsuspected infections. (Infection, page 3-50)

5. **Orthopedics**

Muscle and back strain from frequent lifting and turning patients and moving weights. (Back Care, page 3-11)

6. **Pediatrics**

There is an increased chance of staff succumbing to illness from acute infections on the children's wards. Infections seem more prevalent, and the nursing staff is in closer contact with patients here. (Infection, page 3-50)

7. **Psychiatry**

More chance of injury from unpredictable or violent patients.

8. **Student Nurse**

Stress from suddenly coming into a situation which can be tense and emotional because of the responsibility, and often with a rigid hierarchy in place. Although emotionally immature, she is suddenly facing life and death situations. (Stress, page 3-108)

Injuries from handling unfamiliar equipment.

C. Medical Monitoring

A good basic health assessment, including previous occupational and medical history and the examiner's awareness of the future job demands can assist with correct job placement.

A survey of back and skin conditions will give a good indication of possible problems. Emotional stability and immunization levels would be of prime concern for evaluation. Blood chemistry can rule out underlying infections. Acuity of hearing is very important in a job which is communication oriented, such as in nursing and medical positions. Therefore, there should be a program in place to assess hearing abilities.

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XI. OCCUPATIONAL THERAPY

A. Health Hazards

Injuries due to physical violence from patients. Some patients are psychologically disturbed or they may be very angry and frustrated; the therapist could be the scapegoat.

Dermatitis from handling craft materials and chemicals such as clay, paints or varnishes. (Dermatitis, page 3-36; Chemical Hazards, page 3-19)

Cuts from knives, scissors or "sharps". (Sharps, page 3-105)

B. Medical Monitoring

See Medical Evaluation and Examinations in Section One of this report.

References

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Jones, V. "Is Your Service Really Necessary?," Occupational Health, 29 (December 1977) : 518-523.

XII. PHARMACY

A. Health Hazards

Exposure to chemicals - either solvents (such as benzene) or reagents used for analytic work. (Chemical Hazards, page 3-19)

Eye injury or skin burns from chemical splashes.

Dermatitis or allergic reactions from chemical or drug contact. (Dermatitis, page 3-36)

Exposures to irritating or toxic substances such as cytotoxic drugs. (Cytotoxic Drugs, page 3-29)

Burns or explosions from faulty use of chemicals or the apparatus used.

Ingestion of toxic materials from oral pipetting accidents.

Inhaled exposures from dusts or aerosols.

Cuts from knives or broken glass. (Sharps, page 3-105)

Potential for the abuse of drugs increased with their ready availability. (Employee Assistance Program, page 3-117)

Self-medication, with the familiarity and knowledge of drugs.

B. Medical Monitoring

Medical surveillance would depend upon the substances being used and availability of physiological tests to determine body levels of the substances to which personnel comes in contact.

The health examiner should be aware of the potential for misuse of drugs or medicine with pharmacy workers.

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Jones, V. "Is your Service Really Necessary?," Occupational Health 30 (December 1977) : 26-33.

XIII. PHYSIOTHERAPY

A. Health Hazards

Burns from ultraviolet light (Ultraviolet Light, page 3-92).

Muscle and back strain from moving, lifting and supporting patients, moving equipment. (Back Care, page 3-11)

Infections from patient contact. (Infection, page 3-50)

Shocks from electrical equipment.

Burns from diathermy or heat lamps.

Splashes or burns from hot wax baths.

Caught in or on equipment such as pulleys, ropes and weights.

B. Medical Monitoring

Assessment of back and general muscular strength would be of key importance during a medical evaluation; see the assessement outlined in Section One.

References

Jones, V. "Is your Service Really Necessary?," Occupational Health 29 (December 1977) : 518-523.

XIV. PORTERING

A. Health Hazards

Transportation of very ill patients, including waiting for elevators when the patients' need for medical attention appears urgent, and dealing with verbally abusive patients are all potential stressors for porters.

Difficulty in maneuvering stretchers, trolleys, wheelchairs or other equipment around congested spaces in the hospital, the possiblity of accidents while transporting extra equipment such as oxygen tanks and IV poles, along with stretchers or wheelchairs and the patient, and handling violent patients can cause accidents and injuries.

Risk of infection through improper method of disposal of infected materials, including "sharps". (Sharps, page 3-105)

Back pain from faulty lifting techniques and poor equipment. (Back Care, page 3-11)

B. Medical Monitoring

A good health evaluation, both at preplacement, and periodically, will promote health concepts and provide an opportunity for health teaching.

References

Jones, V. "Is your Service Really Necessary?," Occupational Health 30 (December 1977) : 26-33.

XV. PRINTING

A. Health Hazards

Lifting heavy cases and boxes. (Back Care, page 3-11)

Cumulative steady noise.

Lighting which may be too bright or too dim with shadows.

Burns or shocks from electrical equipment.

Exposure to chemicals which may cause respiratory or skin problems or systemic poisoning. This may occur during the process or while cleaning up spills. (Dermatitis, page 3-36; Chemical Hazards, page 3-19).

B. Medical Monitoring

A good basic health evaluation as suggested in Section One.

XVI. RADIOLOGY

A. Health Hazards

Possibility of excessive exposure to ionizing radiation (Ionizing Radiation, page 3-75).

Risk of infection from contact with infectious patients (Infection, page 3-50).

Muscle or back strain from lifting machinery or patients. (Back Care, page 3-11)

Exposure to irritating chemicals while processing films. (Chemical Hazards, page 3-19)

B. Medical Monitoring

Preplacement evaluation would assess previous occupational history. Special attention should be paid to establishing baseline blood levels of hematocrit, erythrocyte sedimentation rate, hemoglobin, white blood count and differential. This is necessary as a baseline for future reference. Exposure monitoring should be done in accordance with Federal/Provincial regulations.

Any personal or family history of cancer would be documented. Skin and back health should be evaluated and appropriate teaching done.

References

See Ionizing Radiation References (Section Three, page 3-75).

References

Jones, V. "Is your Service Really Necessary?," Occupational Health 29 (December 1977) : 518-523.

XVII. RESPIRATORY

A. Health Hazards

Puncture wounds from obtaining arterial blood gases or other blood samples.

Lacerations from glass apparatus (beakers, tubing, syringes).

Risk of infections from patient contact including tuberculosis, viral hepatitis, etc. from direct airborne and body fluid transmissions. (Infection, page 3-50)

Risk of infections secondary to skin punctures or lacerations. (Sharps, page 3-105)

Cumulative noise from ventilators, monitors, compressed oxygen entering via nebulizers and flooring which does not contain noise attenuators.

Exposure to anaesthetic agents (Anaesthetic Agents, page 3-4).

Potential hazard of working with gases under pressure or in tanks.

Ionizing radiation hazard, when respiratory staff must be present and assisting during x-rays. (Radiation, page 3-74)

Exposure to irritating chemicals (preservatives for specimen collecting, cleaners, liquid sterilizing agents such as 2% gluteraldehyde. (Chemical Hazards, page 3-19)

Potential for burns and shock from electrical equipment - this equipment because of the nature of the work is generally very well grounded and well maintained.

Muscles and back strain possibly due to heavy machinery which needs to be moved. (Back Care, page 3-11)

B. **Medical Monitoring**

Preplacement and periodic evaluations would assess physical health. Special attention would be paid to the back and skin, mental health and the state of immunization. Evidence of exposure to specific hospital infectious diseases like the presence of the Hepatitus B antibody (marker) should be assessed. Depending on contact, assessment for radiology and anaesthetic agent exposure would be evaluated; see the specific topics for more information. Skin integrity is important to assess as is the baseline and periodic assessment of the lungs (including x-ray as appropriate).

XVIII. SECURITY

A. Health Hazards

Because of the nature of the job, the security worker could be subject to physical attacks. Potential verbal abuse from patients and family, staff and outside agencies (law enforcement). (Stress, page 3-108) He must be fit mentally and physically to deal with them.

Patient contact could involve risk of infection (Infection, page 3-50).

B. Medical Monitoring

The security guard would have to be physically and mentally fit. This should be assessed and reinforced during preplacement and periodic health evaluations.

XVIX. SOCIAL WORK

A Social Worker must have very good assessment and communication skills when dealing with people. Constantly dealing with peoples' problems can be stressful.

A. Health Hazards

Sedentary job leading to lack of physical fitness or overweight. (Exercise and Fitness, page 3-15).

Risk of infection from patient contact on the ward (Infection, page, 3-50).

Risk of physical and verbal abuse from an unhappy patient or his family.

B. Medical Monitoring

A good baseline health assessment is fundamental.

The specific area of concern would be targeted by the hazards encountered. These areas would include stress and fitness assessment. This is a good opportunity to assess and teach good mental health and exercise practices. The importance of good hygiene habits to avoid infection should be reinforced.

XX. SWITCHBOARD

A. Health Hazards

Work on the switchboard can present unique stresses, including steady reoccuring demands for various services; the need to take correct action with emergency calls; dealing with rude or impatient callers; and the feeling of physicial and emotional isolation, particularly at night.

Intense audio discharge which exceeds the ear's capability of resistance, can create an acoustic shock. The shock is sometimes produced while the operator is establishing a long distance connection. Repeated shocks can cause injuries to the acoustic nerve and deafness may slowly and progressively evolve.

Acute laryngitis or nodular subacute laryngitis may develop as a result of speaking loudly and/or working in a smoky or dusty environment.

The general state of mental fatigue from working in an area of rapid work rhythym, with sensorial and perception requirements. Some disturbances can be headaches, dizziness and unstable temperament. Often supervision is constant and conversation among staff is prohibited.

Physical effects of a sedentary job. (Exercise and Fitness, page 3-15)

B. Medical Monitoring

Preplacement or periodic health assessment should include an ear, nose, throat, and audiometric examination.

Stress levels arise from verbal abuse from patients or relatives, shift work and lack of recognition in the job. Switchboard operators are heard but not seen, interaction is difficult. The unique stressors present in this type of work should be explained to the applicant, and questions about coping included in future health assessments.

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XXI. VOLUNTEERS

Volunteers are subject to many of the same risks that hospital personnel are; the hazards depend on the area of responsibility. The hazards may, in fact, be greater for the volunteer because they are not in contact with the risks as frequently and their training in hazard control is probably less than the regular staff. There is always a danger of losing sight of the responsibility of safeguarding personal health in caring for others.

A. Health Hazards

Risks of infection (Infection, page 3-50).

If in dietary areas, or coffee shops: burns, shocks, dermatitis from cleaning solutions. (Dermatitis, page 3-36)

Muscle or back strain from wheeling heavy patients. (Back Care, page 3-11)

Injuries from violent patients are often unexpected, therefore the reaction is unplanned, and the volunteer's authority could be uncertain (in the view of both the patient and the volunteer).

B. Medical Monitoring

Medical questionnaire to be taken to the volunteer's own physician would help in establishing a baseline health profile, and an indication for a suitable placement. Often basic good health is a start in preventing problems. Assessment of mental stability is important.

Back health, immunization protection and integrity of skin would be important to establish.

SECTION THREE

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INTRODUCTION

This section will discuss specific health hazards and methods for their control. There are certain basic tenets of control which should be considered regardless of the hazard.

Before a hazard can be controlled, it must be recognized and evaluated. Hazard recognition can be done through regular tours of the work areas by members of the safety committee, the safety officer and/or the occupational health nurse or team. Problem areas can also be identified by infection, illness and accident statistics. Statistics kept by the occupational health service can provide an early warning of problems. Workers should also be trained to spot potential problems and report them to the appropriate person for evaluation and control. Hazard recognition requires that the occupational health personnel know what workers do (up-to-date job descriptions) and what they come in contact with, (current chemicals used). Many methods are used to control hazards, the most obvious being by elimination, by substitution of a less harmful substance or work procedure or by isolating or enclosing the hazard.

Specific factors which should be considered are:

1. Good Housekeeping

Good housekeeping cannot be left unplanned. The overall planning is a management responsibility and it should be organized in such a way to facilitate orderliness and cleanliness.

Storage areas for housekeeping materials and supplies should be conveniently located, ample, well-organized and ordinarily kept locked. The aim is to minimize the dangers of infection, vermin, fire, misuse of reagents, and to avoid being hit by, tripping over or falling against stored objects. Any chemicals and reagents must be clearly marked with the name, direction for use, including ventilation requirements and the personal protective equipment recommended. Directions in case of mishap must be readily available.

Tidiness should be maintained in all departments to avoid creating the potential for trips and falls.

2. **Education**

To minimize the risk to the worker and those around him/her, the new worker must be well oriented to his/her job. An appreciation of safe, healthy work habits and the development of good personal hygiene practices is essential. This orientation should include topics which have direct reference to the workers' job, e.g. the importance of good personal hygiene in food handlers, the hazards of pipette use in laboratories, correct methods for cleaning up spills of chemicals and the importance of eating away from place of work to prevent accidental ingestion of chemicals or infectious bacteria.

Inservice education required to facilitate good work practices should include the use of films, videos, pamphlets, lectures and demonstrations. Many workers may not have English as their first language, this should be taken into account when planning education sessions.

3. **Work Practices**

a) Administrative controls must also be considered as a means of controlling health hazard exposures. This includes limiting access to certain areas to ensure that only authorized personnel with proper training and knowledge of protective equipment can work there, e.g. boiler rooms, and job rotation to minimize exposure to hazards or stressful situations.

b) Protective clothing and equipment should be available and correct methods for use must be taught. Some areas where this may be required are hearing protectors in the boiler room, fume hoods in the laboratory and gown and gloves in the laundry to handle infected linen.

c) Maintenance is important in any industrial setting and particularly so in the hospital. Machinery and equipment must be in good working order, both as a protection for the maintenance workers and also for the hospital staff involved in the job. An example is the gasket and hinges on the autoclave, which must be in good repair to prevent burns. Work instruction should be readily available for the particular machinery being maintained or installed. Equipment should be chosen to avoid hazards to those ordinarily working with or maintaining it.

HEALTH HAZARDS BY TOPIC

I. ANAESTHETIC AGENTS

Several studies, most of which are retrospective epidemiological surveys, indicate both acute and chronic effects from worker exposure to long term low level anaesthetic gases. The purpose of using anaesthetic gases for the surgical patient is to reduce the mental, motor and sensory responses. It is no surprise that Operating Room staff could have similar reactions in proportion to the amount of waste anaesthetic gases present in the theatre. Light refers to an American study which indicates co-ordination and manual dexterity are negatively affected by levels of halothane of less than one part per million (Alberta Occupational Exposure Limit 10 parts per million (ppm) - 8-hour Time Weighted Average - TWA) and nitrous oxide of less than 50 ppm (recommended levels are under study). It is reported that the headaches caused by nitrous oxide (N_2O) are not as severe as those caused by the other anaesthetic agents. The National Institute for Occupational Safety and Health (NIOSH) (1977), agrees with the evidence of diminished responses with respect to cognitive, auditory and visual ability as well as dexterity, shown in human volunteers at levels as low as 50 ppm nitrous oxide, (with or without 1 ppm halothane). NIOSH has recommended TWA concentrations of 50 ppm when nitrous oxide is the sole anaesthetic agent and 25 ppm when it is used in conjunction with halogenated agents such as halothane. At one-half these concentrations, the effects were not seen.

Epidemiologic studies reveal that chronic exposure to low concentrations of gases is associated with specific health effects. The I.L.O. Encyclopedia states that in the majority of studies the incidence of diagnosed spontaneous abortions has ranged from 16 - 38% among women workers in operating rooms, the control group had 9 - 15% pregnancies resulting in miscarriages. There seems to be a difference of opinion in the literature about the incidence of congenital abnormalties in children of parents occupationally exposed to anaesthetic gases. However most of the literature seems to support a higher than normal rate. Most of these studies do not indicate the presence or absence of scavenging equipment or of the levels of anaesthetic gases present. The control groups vary, so comparability of studies is difficult. The NIOSH publication supports the premise that congenital abnormalities among children of exposed workers is increased. A higher incidence of spontaneous abortions and congenital abnormalities in their children was indicated in studies of the wives of exposed personnel. Studies of the wives of unexposed men revealed lower incidences of both. In animals, organ and skeletal abnormalities were seen in the offspring of those exposed to halothane, nitrous oxide and chloroform. NIOSH states that the adverse effects on reproduction are the primary concern in developing recommended standards. In Alberta, standards are currently under review as are standards published by the American Conference of Governmental Industrial Hygienists (A.C.G.I.H.). The recommended levels for Alberta will soon be published in the amended Chemical Hazards Regulation.

Evidence of increased incidence of changes in liver and kidney function especially of female workers, has been revealed from epidemiologic studies. Whitcher concurs with the evidence of liver and kidney disease but includes possible neurologic disorders. He also states that experimental studies on humans reveal that exposure to anaesthetic concentrations of N_2O (50%) depresses bone marrow and immune responses. In animals spermatogenesis is depressed after exposure to N_2O (NIOSH, 1977), and a neurologic lesion resembling pernicious anemia in humans is produced. Whitcher suggests that interference with Vitamin B_{12} dependent enzymes, necessary for DNA synthesis, is the possible mechanism. Light states that studies reveal higher rates of leukemia, lymphoma and other cancers for O.R. staff. Corbett states that in a study of female anesthetists, the cancer rate was three times the normal. The chemical structure of some anaesthetic gases is similar to that of known carcinogens. Clearly there are many suggestions of problems, some with more evidence than others, but an educated awareness must be developed and certainly maximum control measures should be in place.

According to Stringer, Recovery Room personnel face similar threats from post anaesthetic gases which patients breathe out after surgery. Nursing care of the recovering patient requires close contact with the patient. She states that halothane is detected in the end expiratory air of patients for 11 - 20 days after anesthesia. Nitrous oxide was found in the expired air of anaesthetists for 3 - 7 hours following exposure of 13 - 305 minutes. Information from the NIOSH report also indicates that recovery room personnel showed low halothane concentrations in their blood and expired air after a full workday. In the recovery room, the effectiveness of the ventilation systems needs to be assessed and improved as necessary.

A. Methods of Control

1. Environmental Control of Escaped Anesthetic Gases

a) Scavengers are relatively inexpensive and can be applied to anaesthesia carts at any time.

b) The operating room should have a non-recirculating air conditioning system and venting of exhaust should be away from any intake sources. The contaminants can be removed before the final exhausting. Ventilation rates should be adjusted to the anticipated amount of contaminents present. Some studies have suggested this should be 17 air changes per hour.

c) Anaesthetic related equipment must be regularly and carefully maintained to keep it in optimal condition and to detect and correct all leaks and faults. It should have a good flow circuit.

d) The work practices and procedures of the anaethesiologists are important:

   i) scavenging equipment must be turned on,
   ii) avoid spills of volatile gases, clean up promptly if necessary,
   iii) check the functioning of the equipment before each use,
   iv) have a properly fitted mask with a minimum of gas leakage around the patient's face,
   v) use the minimum rate of flow of anaesthetic for the anaesthetizing the patient,
   vi) turn off the machine and gas flow when finished.

2. Monitoring Programs

a) Regular environmental monitoring of gas levels in the operating room. Records of levels to be maintained.

b) Equipment to be checked for leaks and maintained on a regular basis.

c) Medical surveillance to be done as indicated below.

3. Medical Monitoring

a) Should be available to all workers who are subject to occupational exposure to waste anaesthetic gases.

b) Complete preplacement and medical assessment of workers, including family, genetic, occupational and medical history.

c) A complete reproductive history especially information on the outcome of pregnancies of personnel or their spouses should receive special attention.

d) Especially noted should be the medical history regarding liver, kidney and blood as these organs may be potentially affected by inhalation of anaesthetic agents.

e) An initial and periodic medical appraisal at appropriate intervals to include surveillance programs for liver function, kidney function testing and appropriate blood work.

In their article in Occupational Health Nursing, February 1985, Van Den Eeden and Wilkinson give an example of a proposed Health Surveillance Program directed at workers who come in contact with anaesthetic agents. Their main recommendations are for preplacement and yearly health checks. The emphasis of these examinations should be on the hematopoietic, renal, hepatic and reproductive systems. In addition, a complete blood count with differential, LDH, alkaline phosphatase, SGPT, SGOT and bilirubin, blood urea nitrogen creatinine, and urinalysis should be done. Special attention should be given to reproductive history, and especially to a history of problems. This article also contains a useful form for the health monitoring programs.

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II. BACK CARE

Back pain is a complex symptom, and simple solutions are unlikely to be found. In Britain in 1978 it was estimated that almost twice as many working days were lost through back pain than through strikes. A recent report in Alberta indicated that about 25% of compensation claims were due to back problems. Although 80% of the general population is affected at some time or another, the cause of back pain can be identified in only 12-15% of the cases.

A. Understanding Back Pain

Research studies are difficult to compare because a lack of common definitions and methodologies. Most of the studies cited in relation to back problems restrict themselves to the low back area, unless it is explicitly stated otherwise. The psychological aspects of pain make objective measurement very difficult. But current thought is that something can be done to prevent and control episodes of back pain.

Although research is conflicting, there are several predisposing factors which have been linked to developing back pain. The effects of poor posture, poor body mechanics, excess weight, stress and lack of exercise make the lower back particularly vulnerable to injury and pain. These can all be corrected. The worker must be made aware that these factors contribute to back pain and that by adjusting them (s)he can generally have some control over episodes of back pain.

Characteristics of workers with a history of back pain have been studied but only the factors of age and previous history have been supported by research. Data indicate that young workers have relatively higher rates of absenteeism for back problems than older workers. There are several confounding problems so the data is far from conclusive. The relationship between previous and current back problems is strong and suggests the possibility of cumulative changes, permanent changes and/or chronic susceptibility to back problems. One study reported that 65% of workers seeking medical assistance for back pain had had previous problems. The probability of recurrence is high. Other factors studied were sex, anthropometry and the worker's normal posture but there was insufficient data and no firm conclusions. Studies of the relationship of physical fitness to back problems warrant further study.

If the worker has suffered from back pain in the past, (s)he would benefit by learning more about backs. In his book "The Back Doctor" Hamilton Hall, M.D., goes a long way to remove myths about backs and outlines exercises to strengthen and increase flexibility of the back. The worker's personal physician should be consulted before (s)he embarks on a corrective exercise program.

The methods developed to control back pain are screening and then counselling procedures for those most likely to develop the problem. Teaching about lifting and correct body movements is basic. By introducing a program of warm-up exercises to prepare staff for the day's physical activities and promoting general physical fitness and good posture, more emphasis is put on the worker's responsibility to develop positive work habits. Control of personal stress and weight is felt to contribute to developing and maintaining a healthy back.

Statistics, accident investigation, and regular checks for potential hazards should be used to prevent and monitor back injuries.

B. Pre-Placement and Periodic Medicals

In hospitals most of the jobs have some possibility for back strain. Using the potential contributing factors as a guide, a candidate for hospital work should be screened for the possibility of future back problems. By discussing the probable precipitating factors with him/her and offering help in coping with them, back problems could be prevented or minimized. There are several back exercises which could be included in the preplacement evaluation to indicate the workers who might potentially suffer back problems. One recommended program is to administer the exercises suggested in the National Back Fitness Test. The exercises test abdominal strength, quadriceps strength and flexibility of the joints and back. It is wise to grade the screening test to the ability of the candidate or worker; the *"sit up"* test is useful for that purpose. The result of the individual's basic scoring test is an important step into teaching back care and exercises to develop strength, flexibility and fitness.

C. Control of the Health Hazard

1. Education

In Alberta, most of the health care institutions surveyed in January 1978 included proper lifting techniques in their initial formal orientation for new staff and most included the topic in ongoing in-service programs. To date, teaching good body mechanics has been the prime method of control or prevention of back pain. To assist in teaching there are several films available (see reference list). It is felt that "hands on" training is essential in learning how to lift and carry. The physiotherapy department or nursing department usually teach this program. Education about backs is coordinated by the "Back Care Committee".

Components of the mandatory education session are good body mechanics and techniques for back care. The spine and the degenerative processes which affect it, as well as the concept and importance of good posture are presented.

In her report in the Alberta Association of Registered Nurses Newsletter of October 1984, Elaine Meighen, Staff Nurse at the Glenrose Rehabilitation Hospital in Edmonton, discusses the benefits of warm-up exercises to prevent back injuries. In sports, there is a tradition of warm-up exercises to avoid sprains or strains. It was felt that *"warm-up"* exercises would prepare nurses for their day of strenuous physical activity. The exercises consisted of a system of stretching, toning and relaxation performed for 5-7 minutes near the work area, at the beginning of each shift. During the exercises use was made of a musical tape *"Exercise Break"* supplied free from Fitness Canada. Elaine's statistics showed that the incidence of lifting injuries for the six month period when the exercise program was in session were much lower for the participating group than for the non-participants. Some hospitals have developed or are considering developing facilities to encourage physical fitness of staff.

2. But ergonomic factors in the hospital must also be considered. Ergonomics may be defined as *"the scientific study of the relationship between man and his work environment to achieve optimum adjustment in terms of efficiency, health, and well-being."* This adjustment can be made by increasing worker capabilities through selection, training and conditioning or by changing job demands through work redesign, e.g. use of mechanical handling equipment, good storage and shelf design, and when manual lifting must be done, workers should get help for weights beyond their capabilities.

Static postures, when an worker stands in one place for a long period of time alone can cause chronic back and neck problems. Workplace redesign and ensuring that the worker has an opportunity to move or do a different job at regular intervals are methods that can be used to alleviate this situation.

3. There is a definite need to keep careful statistics of back injuries. These can be used to evaluate the effectiveness of control methods that have been instituted.

D. Exercise and Fitness

Exercise, fitness and weight control are important to the maintenance of good health and in the prevention of back injuries, however not all exercise accomplishes the same purpose. The main categories of exercise being currently discussed are those leading to increased flexibility and/or muscle strength and exercise leading to cardiovascular fitness. Only those exercises which significantly increase the blood flow to the working muscle for an extended period of time promote *"cardiovascular fitness"* - a state of body function which enables a person to exercise vigorously for long periods without undue fatigue, and to respond to sudden physical or emotional demands more readily. Examples are aerobics, hiking, jogging, bicycling, swimming, active games or sports. Weightlifting or isometrics build muscle strength. Stretching and movement build flexibility.

Aerobic endurance develops the efficiency of the respiratory system for taking in oxygen, the cardiovascular system in delivering it, and the active muscles and skeletal system in utilizing it.

Before starting a fitness program, workers should always have a medical examination to ensure that there is no health condition which would contraindicate all or some of the fitness activities.

Low intensity and rhythmical activities such as walking or swimming are best for utilizing body fat as fuel. The amount of time involved in moving is the critical factor. High intensity exercises are of limited value for caloric expenditure. Such exercises cannot be done for long enough.

As fitness improves, the physical task can be accomplished over a longer period of time and with greater caloric expenditure.

Regular exercise brings benefits in many ways:

a) It improves blood circulation throughout the body. Lungs, heart and other organs and muscles work together more efficiently.
b) It can assist in the reduction of serious back injuries.
c) It helps an individual handle physical stress, so (s)he can do more and not tire easily. It bolsters enthusiasm and optimism.
d) It is good for psychological well-being; it is a tension release and helps relaxation and sleep.
e) If performed on a regular basis, it may help the body make the best use of fats and sugars (carbohydrates), and protein.
f) It can assist in lowering blood pressure and in weight reduction.

F. Weight Control

Some hospitals have an active program for weight control. The most popular plans are organized inhouse by the staff health nurses or contracted out to Weight Watchers.

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Videos

"The Back Pack", consisting of two 20 minute videos and a manual available from: City Film Distributors, 542 Gordon Baker Road, Willowdale, Ontario M2H 3B4. (Phone 416-499-1400)

Balance on Lifting (20 minute video) available at the Glenrose Hospital.

Working Postures - Nursing Staff (5-7 minute slide/tape). Available from the Glenrose Hospital. Would be appropriate for orientation or inservice.

Working Back. Available at the Film Service, Occupational Health and Safety Division, Edmonton.

Films

Back Injury Prevention Through Ergonomics. National Safety Council 1983 (15 minutes, color). Back injuries reflect greatly on industrial productivity. This film describes integrated programs that through simple engineering can be beneficial to a company.

III. CHEMICAL HAZARDS

Chemicals are commonly used throughout the hospital workplace to maintain sanitary conditions and as a direct agent in the treatment of patients. Hospital laboratories use a wide variety of chemicals in their daily operations. Chemicals in general are to be treated with respect and caution. Workers should avoid breathing chemical dusts, fumes or mists and wash spills off skin as soon as they occur. Familiarity tends to breed carelessness in handling chemicals. Safe practices must be generated through education, safety meetings, inspections and similar conscious actions.

Hazards commonly found with use of chemical agents include chemical burns, toxic effects and carcinogenecity. Control of these hazards is of the utmost importance.

A. Control of Hazards

Various kinds of health hazards may be caused by chemicals used in the hospital industry and eight types of biological effects are described in this section. A flow sheet is provided to outline a procedure for the analysis and control of chemical hazards. To handle chemicals safely, employers and workers need information. Employers are required under Section 24 of the Occupational Health and Safety Act (Chapter O-2, Revised Statutes of Alberta, 1980) to obtain information about certain specified chemicals, and make it readily available to workers. There are also Chemical Hazard Regulations (AR 8/82, 242/83) which specify exposure levels, protection, etc. for a list of designated substances.

Employers should request information from suppliers and manufacturers, when ordering products. The Occupational Hygiene Branch (Alberta), in recognition of the difficulty in collecting some of the required information, has set up the Chemical Hazards

Access Information Program (CHIP) to supply information to employers, workers and occupational health care professionals. Responses to requests for information will include suggestions on the work site control of chemical hazards. The references and books of the Occupational Health and Safety Library, 10709 Jasper Avenue, Edmonton, can also be used for information. To compile information, Material Safety Data Sheets (MSDS) are recommended. Samples of these are included at the end of this section. Workers must be instructed in the safe use of any agents in their work place, and MSDS should be available. Safe use includes correct storage, correct work practices, any personal protective equipment suggestions, suitable antidotes to use in the event of emergency exposures and measures for safe clean-up following spills. If the chemical in question is particularly hazardous and an equally effective non-toxic substitute is available, it would be wise to use the less toxic substitute. The employer, hospital management, has a responsibility to ensure that, if necessary, products are used in well-ventilated areas, and if the chemical is toxic it should be used in an area isolated from most workers, or at least from the unprotected worker. Eye washes and showers must be provided in work areas where chemical spills or splashes may occur, and methods for neutralization and disposal of spills should be readily available.

B. Biological Effects of Chemicals

1. Skin Effects

a) Primary irritation

At the site of contact, primary irritants cause a direct reddening or inflammation of the skin and mucous membrane. The effect may vary from a mild reversible reaction to a serious burn, depending on many factors, including the potency of the irritant and the length of time of contact.

Certain dusts, gases or mists may cause direct irritation of eyes, nose or throat.

Liquid splashes to the eyes may cause pain, tearing and irritation or damage to the iris, cornea or conjunctiva.

b) Sensitization

When skin sensitization takes place, the person affected becomes abnormally sensitive to a particular chemical. There is usually an initial period of contact when no symptoms develop, sometimes this can be several years.

Once sensitized, even a very small contact may trigger a skin reaction. This reaction may not be restricted to the site of contact.

2. Respiratory Effects

Various types of change in lung function could follow inhalation of vapours, dust or aerosols. Some of these changes may occur shortly after a single exposure and are usually reversible, while others occur as a gradual deterioration in lung function after a long period of exposure. Such changes, depending on the agent, could be progressive, even after exposure is removed. Exposure to some agents which effect the lung should be followed by tests to measure and document lung function.

3. Other Exposures

Exposure can also occur after injection or ingestion of chemicals. These would occur in specific circumstances and if the worker is careless about eating, drinking or smoking at the work site. Care must be taken to avoid poisonings; each case of poisoning would be specific to the chemical. Sources of information for treatment should be available for reference.

4. Acute Toxicity

Acute toxicity has been defined as the adverse effects occurring within a short time of exposure to a chemical. The term "*toxicity*" is normally used here to describe the ability possessed by materials such as the systemic poisons to create systemic damage in the organs and systems of the body.

5. Chronic Toxicity

Chronic effects occur over a longer time period than acute effects. The effects could be caused by repeated exposures to small amounts of a chemical, although each exposure is too small to cause an appreciable effect on its own, and also by a large exposure which leaves permanent damage.

6. Carcinogenicity

In healthy tissues, all reproduction is controlled to ensure that new cells are formed at just the rate required to replace old ones. In tumors, control of tissue growth is affected. Particular causative agents, including industrial chemicals such as solvents, and common hospital chemicals such as anaesthetic gases and some anti cancer drugs, have become associated with some tumcurs. There are a number of different mechanisms at work in tumor productions and no singular mode of action can be given to explain the action of all carcinogens. However, considerable evidence has now accumulated to show that many carcinogens interfere with the genetic apparatus of the cell. There are three broad stages in the carcinogenic process; metabolic activation, interaction with tissues and tumor development. At each phase there are a number of influences involved. Factors such as immunological response, hormonal status and other physiological influences will determine tumor growth. Carcinogens may act by interfering with the genetic information in the cells or some may act via an indirect mechanism. The term *"clastogen"* is currently used to describe the general class of substances which produce alterations in all chromosomes. Mutagens are those substances which induce transmissable changes in the genetic material carried by male and female reproductive cells. It has been found that a large proportion of those materials which are mutagens are also carcinogens.

7. Teratogenicity

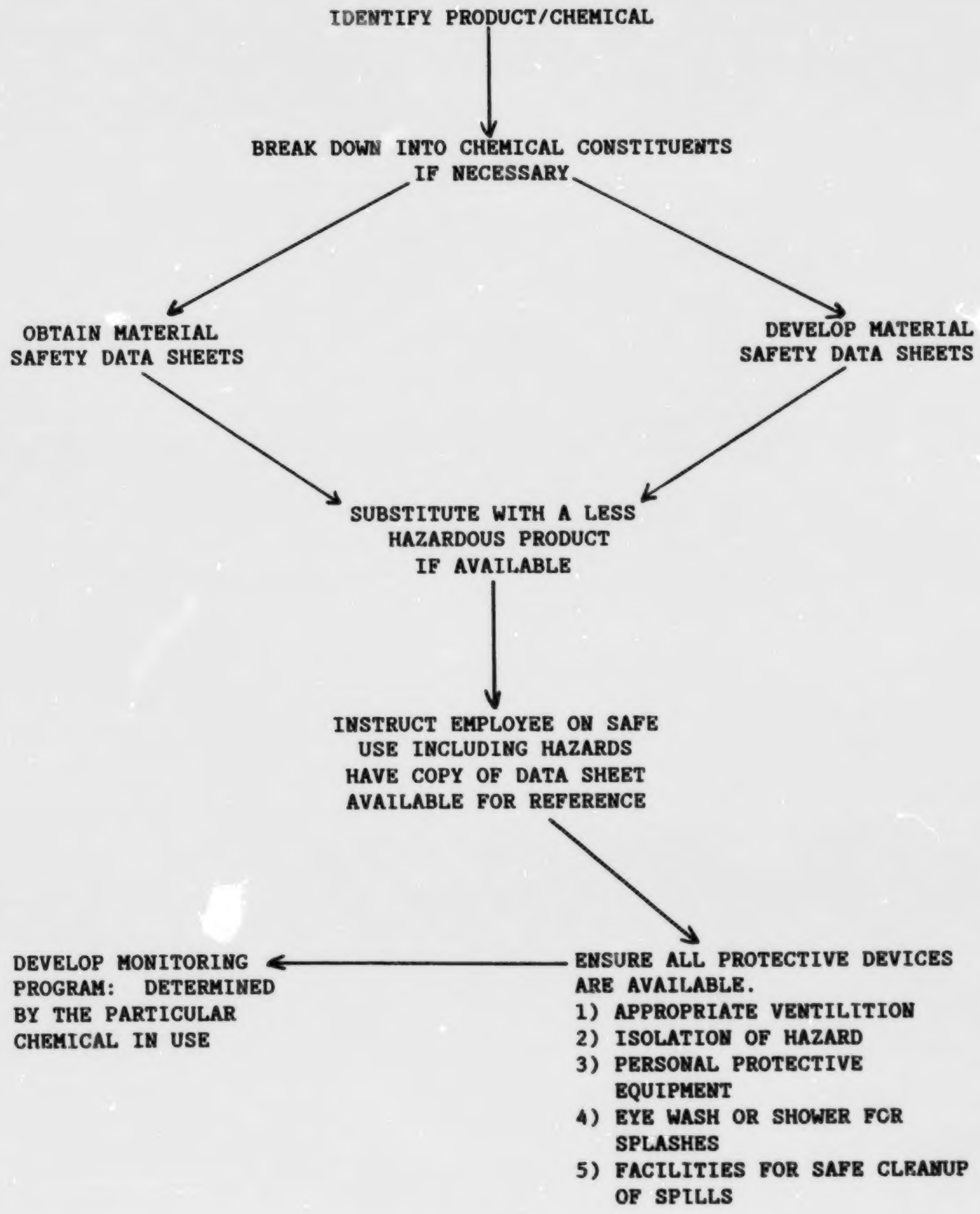
Teratogens are substances which interfere during pregnancy with normal development of the fetus causing malformation. Ethylene oxide, commonly used in hospitals as a gaseous sterilant for heat sensitive materials, is such a chemical.

8. Reproductive Toxicity Effects In General

Chemicals may alter reproduction in ways other than those described in the preceding sections. Fertility of both males and females may be affected. The fetus may experience toxic effects other than those involved in teratogenicity.

Chemicals can have a wide variety of effects on the worker such as diminished sperm counts or testicular atrophy. If the effects of a chemical are known or even suspected, then protective steps should be taken. Information must be collected, documented and made available to those who come in contact with the chemical to ensure they understand the hazard and steps to take to protect themselves.

CHEMICALS HAZARDS FLOW CHART


IDENTIFY PRODUCT/CHEMICAL
BREAK DOWN INTO CHEMICAL CONSTITUENTS IF NECESSARY
OBTAIN MATERIAL SAFETY DATA SHEETS
DEVELOP MATERIAL SAFETY DATA SHEETS
SUBSTITUTE WITH A LESS HAZARDOUS PRODUCT IF AVAILABLE
INSTRUCT EMPLOYEE ON SAFE USE INCLUDING HAZARDS HAVE COPY OF DATA SHEET AVAILABLE FOR REFERENCE
ENSURE ALL PROTECTIVE DEVICES ARE AVAILABLE.
1) APPROPRIATE VENTILITION
2) ISOLATION OF HAZARD
3) PERSONAL PROTECTIVE EQUIPMENT
4) EYE WASH OR SHOWER FOR SPLASHES
5) FACILITIES FOR SAFE CLEANUP OF SPILLS
DEVELOP MONITORING PROGRAM: DETERMINED BY THE PARTICULAR CHEMICAL IN USE

Alberta

MATERIAL SAFETY DATA SHEET

WORKERS'HEALTH, SAFETY,
AND COMPENSATION
Occupational Health and Safety Division
Occupational Hygiene Branch

10709 Jasper Avenue, Edmonton, Alberta T5J 3N3 Telephone: (403) 427-2

Date M.S.D.S. Completed ____________

Product Name

Chemical Synonyms and Family

Manufacturer's Name

Address

Telephone No. ____________ Emergency Telephone No.____________ U.N.No. ____________

I. INGREDIENTS OF PRODUCT

Components	O.E.L. and Date	% wt/wt

II. TOXICITY DATA LD_{50} LC_{50} and SPECIES FOR PRODUCT OR INGREDIENTS

III. PHYSICAL DATA FOR PRODUCT

Boiling Point, 760mm Hg

Melting Point

Vapour Pressure (mm Hg)

Vapour Density (Air = 1)

Solubility in Water % by wt.

Appearance, Odour

IV. FIRE AND EXPLOSION DATA FOR PRODUCT

Flash Point (Test Method)

Flammable Limits in Air, % by vol. Lower Upper

Fire Extinguishing Substances: ☐ Water Fog ☐ Foam ☐ C02 ☐ Dry Chemical ☐ Other (Specify)

Special Firefighting Procedures:

V. REACTIVITY DATA FOR PRODUCT

Incompatibility (Materials to Avoid) ☐ Water ☐ Oxidizing Material ☐ Acid ☐ Base ☐ Other (Specify)

Hazardous Decomposition Products

Can Hazardous Polymerization Occur?

DM 01/84

Product Name

VI. HEALTH HAZARD INFORMATION FOR PRODUCT

EMERGENCY and FIRST AID PROCEDURES

Inhalation

Ingestion

Eyes

Skin

EFFECTS OF OVER EXPOSURE (BOTH CHRONIC and ACUTE)

Inhalation

Ingestion

Eyes

Skin

NOTES TO PHYSICIAN

VII. SPILL OR LEAK PROCEDURES FOR PRODUCT

Steps to be taken upon release or spillage (including neutralizing chemicals)

Waste Disposal Method

VIII. SPECIAL PROTECTION INFORMATION FOR PRODUCT

Ventilation Requirements (Local or General - Specify)

Respiratory Protection (Specify)

Eye Protection

☐ Not normally necessary

☐ Safety glasses with side shields

☐ Gas-tight goggles or equivalent

☐ Safety glasses without shields

☐ Chemical Workers goggles

☐ Other (Specify)

Other Protection (e.g. gloves, coveralls) Special Precautions.
Comments

References used to complete MSDS

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IV. CYTOTOXIC DRUGS

The danger to hospital staff from handling a cytotoxic drug is a combination of its inherent toxicity and the extent to which workers are directly exposed to the drug while carrying out their duties. This exposure may be through inadvertent ingestion of the drug (eating or smoking in the preparation area), inhalation of the drug dusts or droplets, or direct skin contact or puncture. Many of these drugs are mutagenic or carcinogenic in bacteria or animals and have been implicated in causing tumors in man.

A. Effects on Health

The acute affects of exposure are irritation on contact with the skin, mucus membranes and eyes. Contact with or inhalation of the aerosols may result in dizziness, nausea, headache and dermatitis. But the greatest cause for concern is the chronic effect of cytotoxic drugs. Several studies have been done testing the urine of pharmacists and nurses who have been involved in preparing and administering cytotoxic drugs. The tests were for mutagenicity and chromosome damage. The results were positive. (Smoking however also produced positive indicators.) Further tests found that the positive evidence present was related to the lack of care taken in using protective measures during procedures with cytotoxic drugs. There is some evidence that the effects might be cumulative.

In theory, correct and proper technique for preparation of the drugs will completely prevent drug particles or droplets from escaping from their containers while they are being manipulated or administered. Researchers conclude, however, that near perfect technique is uncommon; therefore contamination of the worker and workplace is likely, without protective equipment and other safety measures.

B. Control of the Hazard

1. Education

Instruction about the safe handling of cytotoxic drugs must be given to housekeeping staff, porters, nurses, doctors and pharmacists so each may operate safety in his own realm of responsibility. Some housekeeping staff could be involved in clean up. All personnel who handle cytotoxic agents should receive a copy of the procedures pertaining to their areas. Deviations from the standards should not be permitted except under defined circumstances. Initial training or associated orientation should cover all relevant techniques and procedures, including the proper use of protective equipment and material. Students, residents and medical staff who are not hospital workers should be informed through the customary channels that they will be expected to comply with the established procedures for preparing, administering and disposing of cytotoxic drugs and their associated waste. Knowledge and competence of personnel would be evaluated periodically and the results documented. This could involve a combination of a written examination and direct observation of the individual's performance.

2. Safe Preparation of Cytotoxic Drugs

The facility using the cytotoxic drugs should have clear policies and procedures for the drug preparation and administration. There should be a method in place for receiving these drugs at the hospital. Workers who transport them to the pharmacy or the nursing units must be fully aware of the hazard and of emergency procedures in case of accidents. The drug should be mixed in the pharmacy using the biohazard cabinet, with the worker wearing protective clothing. Preparation and administration involves both aseptic techniques to maintain sterility, and protective measures for staff in recognition of the chemical hazard. Technique is important to avoid creating an aerosol of the drug during preparation. Access to all areas where cytotoxic drugs are stored or prepared is limited to specified authorized staff. Handwashing should be done before and after gloving. The amount of drug solution penetrating the glove material increases with contact time and decreases with the thickness of the glove. Latex gloves and double gloving are recommended. In areas where cytotoxic drugs are used, there is to be no eating, drinking, smoking, application of cosmetics or food storage. Oral pipetting is strictly prohibited. The hood where preparations are done is to be disinfected and cleaned regularly. Pharmacy is to have sufficient information on the safe use of all cytotoxic drugs available in the hospital. This would include a file with information about toxicity, acute exposure, treatment, chemical inactivators, solubility and stability of cytotoxic drugs. Pregnant and breast feeding staff should not be involved in handling these drugs.

3. Personal Controls

Masks are an optional benefit with regard to staff. Goggles are optional but contact lenses can be a hazard in event of a splash. Handwashing before and after gloving and gowning are important for personal protection. Waste handling methods are very important to ensure protection of all hospital staff. Care must be taken with the hard (including *"sharps"*) and soft garbage, linen and any patient waste. Disposal of any one of these materials must have a safe procedure available. Soiled linen is treated like infected linen, it should be put in a special bag and handled with gloves. The recommended method is to put it in a water soluble bag and prewash it before processing with the regular laundry. Cytotoxic drugs are chemical hazards not biological ones.

4. **Treatment of Personal Contamination by Cytotoxic Drugs**

a) Eye splash - flush eyes with copious amounts of clean water for 15 minutes. Remove contact lenses if worn. Report to emergency for follow-up. Notify supervisor.

b) Skin Splash - remove contaminated clothing quickly. Wash drugs away with copious amounts of water. Report to emergency for follow-up. Notify supervisor.

c) Skin puncture - if accidently pricked or injected with a needle, follow extravasation procedures. Report to emergency for follow-up, notify supervisor.

d) In the event of a spill, try to contain the spill. Every area using these drugs is to have available a spill kit (contents: goggles, large disposable gown, two pairs of large latex or P.V.C. gloves, face mask, 12 incontinent pads, large garbage bags, all colour coded for biohazard waste). Pharmacy will advise if there is a neutralizing solution. Place all material used in a chemotherapy waste container - usually double plastic bags. Wash the area clean with 5% hypochlorite solution, then soap and water and then again wipe down with water. Personnel involved are to wash hands with hibitane skin cleanser for at least one minute after the clean-up. Incident reports are to be filed for all above accidents. A recent survey carried out in the United Kingdom identified two quite different situations where cytotoxics are used: in pharmacies linked to major chemotherapy departments and pharmacies in hospitals either not involved at all or only rarely. The potential for two codes of practice was indicated. The infrequent user was most likely not to have detailed procedures, and this is often the situation where the most advice was required.

C. Medical Monitoring

There is no highly reliable biological monitoring procedures for the identification of those at risk from exposure to cytotoxic drugs. But for workers who will be regularly exposed, it is recommended that a reference blood sample be taken and stored upon employment. Proper controls are the obvious means of preventing exposure. However, there are two tests which used over a yearly basis would provide additional evidence that controls are working. Urine samples can be tested for mutagenicity (no use in smokers). Positive results in non-smokers could indicate that workplace controls are inadequate. Further tests are recommended until the tests are negative. The second test is an annual blood count, which provides a group indicator of possible exposure. Results are difficult to interpret individually.

Medical surveillance would include a pre-employment evaluation in which each person assigned to work with cytotoxic drugs is given a complete physical examination, including a complete blood count and a differential count.

Pregnant or possibly pregnant women should not be exposed to cytotoxic drugs because of the terratogenic risk. When a pregnancy is planned, a precautionery measure would be to avoid working on cytotoxics. Staff exposed to cytotoxics should not be exposed to radiation. This recommendation follows evidence of a synergistic effect between certain cytotoxics and radiation in patients treated with both.

Hospitals should consider the feasibility of establishing a medical registry of hospital personnel who routinely prepare and administer chemotherapeutic agents. This could provide future epidemiological data to help define the occupational health hazards associated with these drugs.

D. Conclusions

Health professionals who work with cytotoxic agents should be aware that:

1. Many of these drugs are strong chemicals which can cause direct injury to skin, eyes, mucus membranes on contact.
2. There are reproducible data to demonstrate the mutagenic and carcinogenic properties of these drugs.
3. There is strong evidence that tumors may be induced when alkylating agents are administered in therapeutic doses.
4. Evidence of risk is minimized when all precautions are taken when handling these drugs.

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V. DERMATITIS

Occupational dermatoses occur more frequently than the total of all other industrial diseases on the North American continent. Occupational dermatitis is a general term used to designate an inflammation of the skin, resulting from exposures to irritants or sensitizers in the work environment. Causes can be classified under four headings: chemical compounds, mechanical agents, physical agents and biological agents.

Most hospital occupational dermatitis is caused by irritants which exert a direct action on the skin at the point of contact. The skin response depends on the integrity or the condition of the skin, the strength of the irritant and the length of time it is in contact with the skin. Dermatitis caused by contact with a primary irritant is referred to as contact dermatitis. A primary irritant is one that is found to produce a recognized irritating effect at the area of skin contact. Primary irritants, affect everyone. Once it is recognized that there is an irritant, skin contact should be eliminated as soon as possible, either by substituting another chemical or by wearing protective gloves and a gown. While a contact dermatitis due to a primary irritant can be severe and require medical treatment, the worker can usually return to his regular job just as soon as his dermatitis is brought under control. His dermatitis should not recur providing he avoids contact with the irritant material.

An allergic response to a specific substance can sometimes occur in susceptible individuals. Some substances and some individuals are more likely to be implicated than others. The worker may not be able to continue working with this material.

Other causes of dermatitis are mechanical agents such as friction and pressure which cause blisters and calluses. Physical agents refer to excessive heat and cold, sunlight, ultraviolet light, x-ray and other ionizing radiation which can produce harmful skin effects. Biological agents, which include bacteria, fungi and parasites such as mites and ticks, attack the skin and produce primary or secondary types of skin disease.

Frequent hand washing is both a cause and a control measure in dermatitis. Frequent handwashing is necessary in a hospital setting to control personal contact with chemical agents, and prevent the spread of infectious microorganisms. In the process of frequent hand washing, protective oils are destroyed, leaving the skin open for inflammation or dermatitis. It may take many days before a clinically noticeable change has occurred. With skin breakdown there is irritation which is annoying and can open the skin to infectious invasion.

A. Prevention of Occupational Dermatitis

1. Depending upon the irritant, handwashing can also be the solution to avoiding irritation caused by a chemical. It is washed away. Personal hygiene is the most important single means of protection against dermatitis. However too much washing with strong soap or skin cleaners can cause skin breakdown. This can be lessened with the use of a milder soap and applying creams as appropriate. Clothing should be changed if it becomes contaminated and laundered regularly.

2. Substituting for a less irritant chemical.

3. Handling method: If it is necessary to handle a hazardous material, it should be done in a manner to reduce exposure to workers. An enclosed system of processing preferrably with negative pressure, wet handling instead of dry brushing or spraying, vacuuming instead of sweeping or mechanical handling facilities could all be used.

4. Ventilation: Local exhaust is particularly effective. Use general ventilation if there is no local exhaust or to complement local exhaust.

5. Segregation: Processes using dangerous materials should be segregated so that a minimum of workers are exposed.

6. Personal protective equipment: Including respirators, special clothing, impervious gloves, goggles, sleeves and aprons. The right equipment should be chosen for the hazard involved. Barrier creams are of limited value.

7. Medical supervision: Assessment of skin should be done beginning at the preplacement evaluation and then periodically. The frequency would depend upon type and severity of exposure. This examination may detect individuals who because of a past history of skin reactions to certain materials may have to avoid them entirely. Depending on the chemical contact, these evaluations should continue for a period of time after worker's removal from contact.

8. Education and supervision: Both the worker and management should be instructed on the possible dangers, proper safeguards and handling of problem materials.

9. Air Sampling: Threshold Limit Values, (TLV's) have been adopted for many hazardous substances. Sometimes a regular monitoring system is necessary.

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Slides/Cassette

Planning a Skin Hygiene Program. Fifteen minute slide/cassette describing how a "program" approach can reduce skin problems through awareness of personal care and hygiene. Available through CSSE (Canadian Society of Safety Engineering, 1087 Meyerside Drive, Suite 5, Mississauga, Ontario, L5T 1M5. (Phone 416-678-1668)

VI. ETHYLENE OXIDE (EtO)

The application of heat is generally the most desirable method for sterilizing materials in the hospital. To sterilize heat sensitive items, ethylene oxide is the preferred method but its use should be limited to heat or moisture sensitive materials for which there is no substitute sterilant. The process involves placing the items in the sterilizer and infusing it with EtO. When the process is finished the items are transferred to the aerator for about 24 hours. During the sterilization procedure, according to the Hazard Alert #3 Report (1982), exposure of staff to EtO can occur:

1. The highest exposure may happen while opening the sterilizer door. Evacuation of this gas should be complete before the door is opened. If not, levels could briefly reach 1000 ppm. Ventilation should be designed to reduce this exposure and workers should leave the area until EtO levels reach a minimum as determined by monitors.

2. Exposure can occur while materials are being transferred from the sterilizer to the aerator while changing cylinder tanks and at the gas exhaust point.

Ethylene oxide can enter the body by inhalation as a gas or slightly by direct skin contact (it becomes a liquid below 10°C). Most people cannot smell the sweetish ether-like odor of EtO until it reaches a hazardous concentration (HESIS, 1982).

A. Physiological Effects

Ethylene oxide is an irritant of the eyes, respiratory tract, and skin; at high concentrations it causes central nervous system depression; it is carcinogenic in female mice.

In humans the early symptoms are irritation of the eyes, nose and throat and a peculiar taste in the mouth; effects which may be delayed are headache, nausea, vomiting, dyspnea, cyanosis, pulmonary edema, drowsiness, weakness and incoordination, and electrocardiographic abnormalities.

B. Control of Hazards

1. Engineering Controls

Ethylene oxide is an extremely volatile, flammable liquid with a vapour that forms an explosive mixture with air at concentrations greater than 30,000 ppm. This requires removal of all ignition sources, including static electricity where EtO is in use. Storage facilities should be away from heat, strong oxidizers, strong acids and alkali. Foam, carbon dioxide or dry chemical fire extinguishers should be readily accessible (a solid stream of water will scatter or expand the fire). Automatic water spray systems should be provided to cool the sterilizing equipment in case of a nearby fire. All EtO work areas should be maintained under a negative pressure. Local exhaust hoods should be located at areas where the possibilities of highest concentrations exist. Sterilization operations involving EtO should be isolated from all non EtO work areas.

All facilities should have a written program for preventive maintenance of the sterilizer, aerator and exhaust systems, to be carried out by trained staff. Details of maintenance should be recorded. As EtO can cause deterioration of gaskets, seals and fittings and result in leaks, careful maintenance is an essential prevention measure. To assure a safe work environment and comply with legal limits, monitoring of EtO concentrations during and after normal use of sterilizing equipment is recommended. As well, sampling should be done in the EtO storage area and during and after changing the cylinders of gas. Ventilation and exhaust systems must succeed in removing the EtO from the work environment.

2. **Personal Controls**

With a spill or leak, evacuate all but those trained personnel necessary for cleanup of gas or liquid. Contaminated clothing should be discarded and if it is to be washed, labelled well. Use special types of protective clothing which are effective when working with EtO. Goggles are recommended. Appropriate respirators should be available in case of spills. Facilities should be available to wash contaminated skin areas. Workers must be well informed of hazards and comply with safe work practices.

3. **Education**: All workers operating sterilizing equipment should be well instructed in all areas of safe sterilization and aeration procedure. They must also be taught the nature of the hazard, signs, symptoms of acute exposure and how to use respirators. They should also know how to clean up a spill safely.

C. Medical Surveillance

Medical surveillance should be available to all persons exposed to ethylene oxide at work. Both acute and chronic effects should be evaluated and reproduction histories should be recorded.

1. Preplacement Medical Examinations

Preplacement examinations should include at least:

a) Comprehensive medical and work histories with special attention paid to eyes, blood, lungs, liver, kidney, nervous system and skin.

b) Thorough physical examinations with particular emphasis given to pulmonary, neurologic, hepatic, renal, and hemopoetic systems and skin.

c) Complete blood count to include at least a hematocrit, white cell count, differential count, and hemoglobin.

2. Periodic Medical Examination

Periodic examinations should be available at least on an annual basis, more frequently if indicated by individual health status or emergency exposure. Included should be:

a) Interim medical work histories.

b) Physical examinations as described for preplacement.

c) Complete blood count including hematocrit, white cell count, differential count and hemoglobin.

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VII. **HEAT**

Heat is encountered in several areas of the hospital, the laundry, the kitchen, and the boiler room. The human body functions efficiently within quite a narrow range of external temperature, at 2° plus or minus 37°C. At temperatures above normal, the body must take action to cool itself. The body mechanism for cooling is to perspire; the evaporation of the perspiration from the skin has a cooling effect. If fluid is taken in at a similar rate to that lost through perspiration, few health effects will occur. When more body fluid is lost, the worker may become dizzy, irritable, and inattentive and is thus more likely to be involved in an accident.

The kitchen, the laundry room, and the boiler room have both, high heat and high humidity, which can result in uncomfortable working conditions. Only if workers are unable to get cool or are very sensitive to heat will more serious health problems arise.

A. **Physiological Effects**

Symptoms of over exposure to heat range from a heat rash (tingling & burning of the skin, red itchy rash) which is cured through cool showers; to heat cramps from loss of body fluids & minerals like salt; to heat shock when the body gives up cooling itself. Fainting can also occur. The flow sheet describes the three main effects from heat. The symptoms of heat exhaustion are: tiredness, weakness, dizziness, clammy skin, slow, weak pulse and complexion which is pale or flushed. The treatment is to lie down in a cool place and sip cool fluids. Prevention is frequent rest breaks and intake of plenty of cool not cold fluids. More serious is heat stroke, the body temperature is high (40-43°C), skin is dry, the worker could be confused, have seizures or lose consciousness. This is an emergency, start cooling the victim immediately, transport to emergency medical care.

B. Control of Hazards

1. Administrative Controls

Rest breaks in a cooler area help prevent illness as a reaction to heat. The combined effect of humidity and heat can be measured using a wet-bulb globe temperature reading (WBGT).

At a given temperature, the higher humidity, the greater the heat stress. A chart relating continuous work to recommended rest breaks is available in the newly written Guideline For Workers Exposed to Heat (Butler, 1985).

Workers become gradualy acclimatized to hot, humid areas in 4-5 days, but a week's absence and it is quickly lost. Physically fit workers adapt to heat better than unfit ones.

2. Education

All staff in hot areas should be made aware of the symptoms of heat exposure and how to reduce the effects. These are: take care to increase salt intake (if medically permitted) by adding salt to food, (salt tablets are rarely needed); increase fluid intake (about 1-2 cups per hour, maximum); and periodic removal from the heat. The time/rest proportion is in relation to the temperature (WBGT) and the degree of strenuousness of the work being done.

3. Engineering Controls

Measures must be taken to control excess heat. This can be accomplished by a good ventilation system and by insulating the main source of heat.

4. **Personal**

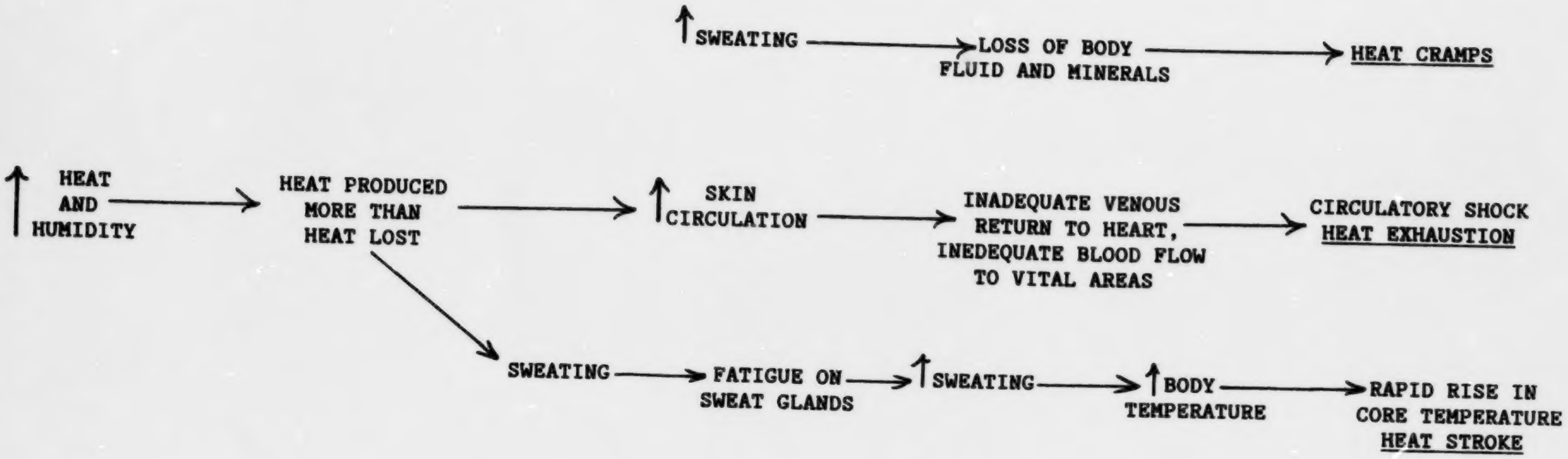
Fluids should be provided. If no medical condition contraindicates, the worker should be encouraged to eat salted food. Clothing worn should be porous and lightweight.

C. **Medical Surveillance**

Workers who work or will work in hot areas should be fit and healthy. Those who have chronic diseases, are obese, pregnant, elderly or abuse alcohol, usually develop problems from heat exposure more quickly than fit workers. Those with salt restricted diets should consult their own physician before taking extra salt. Anyone who has in the past, had heat stroke, will more easily have a recurrence and, therefore, should avoid heat exposure.

Heat affects some people to a greater degree than others. Supervisory staff should be aware of heat effects and how to control them. The worker should also be well aware of symptoms and controls and should take suitable steps to avoid illness.

INCREASED HEAT EFFECTS


↑ SWEATING
LOSS OF BODY FLUID AND MINERALS
HEAT CRAMPS
↑ HEAT AND HUMIDITY
HEAT PRODUCED MORE THAN HEAT LOST
↑ SKIN CIRCULATION
INADEQUATE VENOUS RETURN TO HEART, INEDEQUATE BLOOD FLOW TO VITAL AREAS
CIRCULATORY SHOCK
HEAT EXHAUSTION
SWEATING
FATIGUE ON SWEAT GLANDS
↑ SWEATING
↑ BODY TEMPERATURE
RAPID RISE IN CORE TEMPERATURE
HEAT STROKE

ADAPTED FROM: Olishifski, J.B. Fundamentals of IndustriaL Hygiene, 1983, p. 376

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VIII. INFECTION

A. General Infection Protocol

Infections enter the body by similar pathways to chemical poisons: injection or absorption through skin or mucous membranes, inhalation or ingestion. When there is an opening in the skin or the integrity of the skin is compromised by dermatitis, infection can enter, a healthy unpunctured skin is necessary to withstand infection. Airborne infection is inhaled or ingested. To avoid ingesting infectious materials, eating, drinking or smoking should be done only in designated areas, never at the worksite. The key is to shield the appropriate routes of entry when considering forms of personal protection from contagious organisms. Good attention to personal hygiene is essential to avoid hospital infections.

A second main method of primary prevention is by immunization. All hospital staff should have up-to-date immunization. Workers must not introduce preventable diseases into the hospital environment. Patients in hospital are likely to be in an immunocompromised state and any invading organism will claim more victims and will spread more quickly than in the community at large.

Sometimes contracting an infection is inadvertent. On admission of the patient to the hospital, all diagnoses may not be known. There may be a covert infection in addition to the presenting admitting diagnosis. Incompletely diagnosed or undiagnosed illness or infections must be treated cautiously. Admitting staff must be very observant of the new patient and very discrete in their contact to avoid infecting themselves and their colleagues.

Workers need guidelines for protective measures, especially as world travel becomes more common and consequently, there is the potential of more contact with exotic diseases. There is a great deal of tension when a patient with an exotic infectious disease arrives to be cared for. The degree and methods of protection are determined by the organism, its route of entry, capacity for rapid transmission and its mortality rate. The greatest risk is with a virulent organism which is unrecognized until it has spread. In the Infection Control Guidelines Manual, the routes of entry and control methods for specific diseases are well documented. The same principals which work for patient protection from nosocomial diseases apply to preserving staff health: awareness of the particular organism and the application of appopriate protective mechanisms.

1. Control of Hazard

   a) The hospital must have a policy in place governing infection control. The application of this policy requires a set of guidelines specific to each organism to guide staff in their expected behaviour; both to contain the infection and to protect staff members. There must be centers which are prepared to care for the patients with the more exotic or more potentially fatal contagious illnesses.

   b) Housekeeping requires written procedures and ongoing worker training to create and maintain hygienic conditions in hospitals. Procedures must be in place to maintain the effectiveness of detergents and to avoid promoting cultures of infection in either solutions or equipment. To protect themselves, housekeeping personnel must have a good working knowledge of personal hygiene and protective principles. They must also be taught any applicable infection control measures.

c) Hospital staff require a good set of guidelines specific to each disease if necessary to be able to apply suitable personal protective measures. Recommended equipment for maximum protection must be available. The methods to sanitize or sterilize equipment and supplies must be effective. Depending on the organism, minimal patient care should be considered. This could be organized so that the time staff spend working close to the patient enables the maximum care to be given in the shortest time possible.

d) Ventilation must be adequate to remove airborne organisms, optimumly these are then killed before being dispersed into the general atmosphere.

e) The patient, at the time of hospital admission, must be observed carefully for all signs of illness. Appropriate screening tests have to be considered, e.g. tuberculosis has frequently been missed until hundreds of hospital staff members have been in contact. These contacts must then all be located and tested (see T.B. later in this section).

f) Statistics must be kept regarding staff infections; there must be a close liaison between the Occupational Health Nurse and the Infection Control Nurse in developing a good program for staff protection. The statistics kept will indicate if controls are working as they should.

g) The occupational health team during their walk throughs can often spot inconsistencies of infection control, in general; for example, laundry traffic through the kitchen. Because each area is most directly concerned with itself, inappropriate actions by other departments may be missed.

h) A very prevalent source of staff infection is inconsistent *"sharps"* disposal. Everyone is at risk until the sharp item is finally placed in a hard disposal container. The user of the sharp is responsible and anything other than proper disposal is negligent. Clipping the needle is not to be recommended as it potentially creates an aerosol form of the injection substance, thereby creating the potential for sensitivity.

i) Equipment and supplies must be suitable disinfected. The guidelines will state appropriate methods. Waste must be properly disposed of (see Waste Management, page 3-126).

j) Hospital workers who are carriers of an infection must be knowledgeable about the control of the disease, and should only work in areas which would not put anyone at risk, staff or patient.

k) Standards of care and protection must be defined and explained throughout the hospital. The Infection Control Committee must establish a system of identification and reporting of infections; they study changes in incidence and make recommendations on the use of antibiotics, disinfectants and the type of aspectic technique for the staff to use. For diseases of unknown etiology, some method of care must be defined; the potential for staff illness and high staff stress is involved.

2. Education

Many of the staff members will have a basic understanding of infection principles, but this needs to be built on. There are new methods and considerations when dealing with infection and high awareness about infections must be continuously stressed. Some workers will need intensive education. Some way of testing knowledge must be developed before an infection situation is encountered by a novice. Procedures must be developed to guide staff with reference to each departments' responsibilities for each type of organism. An appreciation must be developed in the worker of the value of her/his own health to maintain the consistent vigilance necessary to protect her/him from the infection. Policies developed by the hospital should reinforce this.

3. Medical Monitoring

During preplacement and periodic health evaluations, hospital staff must be evaluated for presence of infections. The hospital worker should feel confident about reporting to the Occupational Health Service regarding infections which develop during the time he is employed in the hospital.

The immunization of all hospital staff must meet current requirements. This may mean in some cases commencing a primary series of immunization if a candidate was not previously immunized. It is felt that all hospital workers, male or female, should be screened for the rubella antigen. If negative, and the worker is not pregnant or planning a pregnancy within the three to six months, the immunization should be given. An informed and written consent from the worker is necessary. See the schedule of recommended immunization which follows this section (page 3-56). In some cases a medical decision may be required about hiring individuals with certain physical conditions for work with infectious material. Candidates with a single kidney or a dermatitis would fall into this category, as would someone who is immunocompromised for any reason.

Some infective diseases have come to special attention because of high morbidity or mortality rates. Receiving current attention are AIDS, Hepatitis B and T.B. See pages 3-58 to 75.

B. RECOMMENDED IMMUNIZATION FOR HOSPITAL WORKERS

Diptheria: History of a primary series plus booster every 10 years. If no primary series, this should be carried out.

Tetanus: History of a primary series plus booster every 10 years. If no primary series, this should be carried out.

Poliomyelitis: History of a primary series. If no primary series, this should be carried out with IPV.

Polio Boosters: Polio boosters are no longer recommended every 10 years for adults.

Rubella: All susceptible male and female health workers should be vaccinated with rubella vaccine following serological testing.

The immunization of all sero-negative health workers is advocated in order to minimize the possiblity of transmission of rubella to patients or female staff in the first trimester of pregnancy.

Tuberculosis: In view of the declining incidence of tuberculosis and the increasing importance of skin testing in case finding and monitoring tuberculosis infections, the use of BCG vaccine is not recommended in most hospitals. However, exceptions may be made in situations of high risk.

Tuberculin skin testing should be carried out every 4-6 months in hospitals with a high admission rate for tuberculosis. In other health care settings or institutions tuberculin testing should be done yearly.

From the schedule provided by the Edmonton Board of Health, January 19, 1985. Polio recommendations were revised following the conversation with Dr. Waters, March 1985.

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C. AIDS

The epidemiological transmission pattern of AIDS is similar to hepatitis B, by blood and body fluids. However, available evidence indicates that this disease is less infectious and less rapidly transmitted by direct contact than hepatitis B.

The AIDS virus infects only specific cells of the immune system, called T-helper cells. The responsibility of these cells is in stimulating the production of antibodies, to help the body to fight infection. Once infected, these cells cease to grow and multiply, leaving the victim open to infection by any virus or other pathogen with which they come into contact. The evidence is overwhelming that the virus, HTLV-III is the causal virus as recently claimed almost simultaneously by research teams in Paris, France and Bethesda, Maryland, USA. It now should be possible to develop a vaccine, to protect people at risk. The incubation period can be quite long and varied, average is 30 months in adults, but possibly 5 years or longer. For children, the incubation period averages 20 months.)

Most cases appear to have been acquired by very intimate contact with distinct subgroups of people. In December, 1983, it was stated that there was no evidence to suggest that the rate of contracting AIDS is any higher in the health care persons than in any other low risk population groups. There has been no evidence of person to person transmission through ordinary social or occupational contact and no evidence of airborne or food borne transmission.

The virus has been isolated from blood, semen, and saliva of patients suffering from AIDS. AIDS, as such, in an infected patient requires only blood/body fluid protection precautions just as for hepatitis B. If there is another infection present, it would determine the additional precautions which would be added according to the recommended guidelines. Otherwise special precautions other than the blood/body fluid are considered unnecessary. Frequent hand washing even with the use of gloves, is a good procedure to use after routine care of an AIDS patient. Sharps, needles or scalpels, because of their blood precautions, must be very carefully and completely disposed of by the user. Like hepatitis B precautions, eye goggles and masks are recommended in situations of possible of splatter of blood or other body secretions such as when suctioning. Disposable ambubags or oral airways should be available if they are likely to be needed for use with an AIDS patient. Masks for workers are recommended if extensive care is planned. Blood and other specimens should be prominently labelled with an appropriate warning and blood should be double bagged for transport. Linens and laundry should be specially bagged and labelled. Care must be taken that all instruments used are cleaned and sterilized. Blood spills should be cleaned up promptly with the recommended solution of hypochlorite. Laboratory and autopsy precautions must be very strict.

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AIDS, After the Fear, 20 minutes, 3/4 and 1/2 inch tapes VHS, The Faculty of Medicine, University of Toronto, Instructional Media Services, VHS, March 1984.

C. Hepatitis B (HBV)

Viral hepatitis is found world-wide and is one of the most frequently encountered of the infectious diseases. Classifications of hepatitis are: viral hepatitis A (VHA - infective hepatitis); viral hepatitis B (VHB - serum hepatitis); or viral hepatitis - non A, non B. Because hepatitis generally has a protracted course and a number of the cases are marked by later complications, the illness should always be treated as serious. Typical symptoms are not always apparent and there are many undetected cases. All types of hepatitis are classified as potentially causing disease, unnecessary disability, or untimely death. All forms of hepatitis are preventable.

1. Control of Hazards

Serum hepatitis or hepatitis B is spread by intimate personal and sexual contact, or by other direct or indirect mechanisms of transmission of infective body fluids (blood or blood products, saliva or semen), by obvious or inapparent parenteral routes. In an infected individual, virtually all body fluids have evidence of hepatitis B.

The incidence of illness is much higher among medical and paramedical personnel than in the general population. Susceptible occupations are dentists, laboratory personnel, staff working in renal units or blood transfusion units and sexually transmitted disease units. Markers of hepatitis B virus infection have been identified and laboratory tests are available for most of them. By testing serum for these markers it is possible to diagnosis acute or chronic infections due to the hepatitis B virus, and to determine prior immunity or susceptibility to the virus. Presence of any of these markers imply prior infection; absence of all identified markers, susceptibility. The danger exists not only with patients who are suffering from acute, positively diagnosed virus hepatitis B, but also with patients whose illness is undiagnosed and with virus hepatitis B carriers. Carriers who are employed as medical personnel and are in close contact with patients should not present any particular risk of infection, provided the necessary preventative measures are observed.

The incubation period for serum hepatitis can be six weeks to six months. The clinical features are malaise, anorexia, nausea, headache, pyrexia, myalgia and usually jaundice.

Passive immunization is mainly used for exposure by accidental innoculation, ingestion or splashing of the conjunctiva with known HBV - positive blood. The injection should not be delayed by waiting for results of blood tests but should be given within forty-eight hours after parenteral or mucosal exposure. A repeat injection is given four to six weeks later. The intramuscular vaccine for active immunization is available to be given to hospital workers who are most likely to be in contact with blood or body secretions of infected patients. Institutions should develop procedures assigning priorities to the worker groups at risk of acquiring hepatitis B in order to facilitate effective protection of those of highest risk. Those whose work assignments place them at the highest risk should be tested at the time of employment. There should not be a disproportionate reliance on protection of hepatitis immune globulin or hepatitis B vaccine because it will not protect against the much more prevalent and equally dangerous non A and non B hepatitis. Good hygiene and awareness of self protective measures remain the best most effective method to avoid contracting the disease. Although it is too early to assess the long-term protective affect of hepatitis B vaccine, it is expected to persist for at least five years when a booster injection may be required.

2. **Education**

Since hepatitis B is regarded as a preventable disease, it follows that the staff should be well educated about the disease and its prevention. Considering its method of transmission this should be possible, provided the individual who has the disease is detected. A blood test is required to screen for the disease, especially in areas such as renal dialysis and intensive care where staff contact with infected blood or mucous is sometimes inevitable.

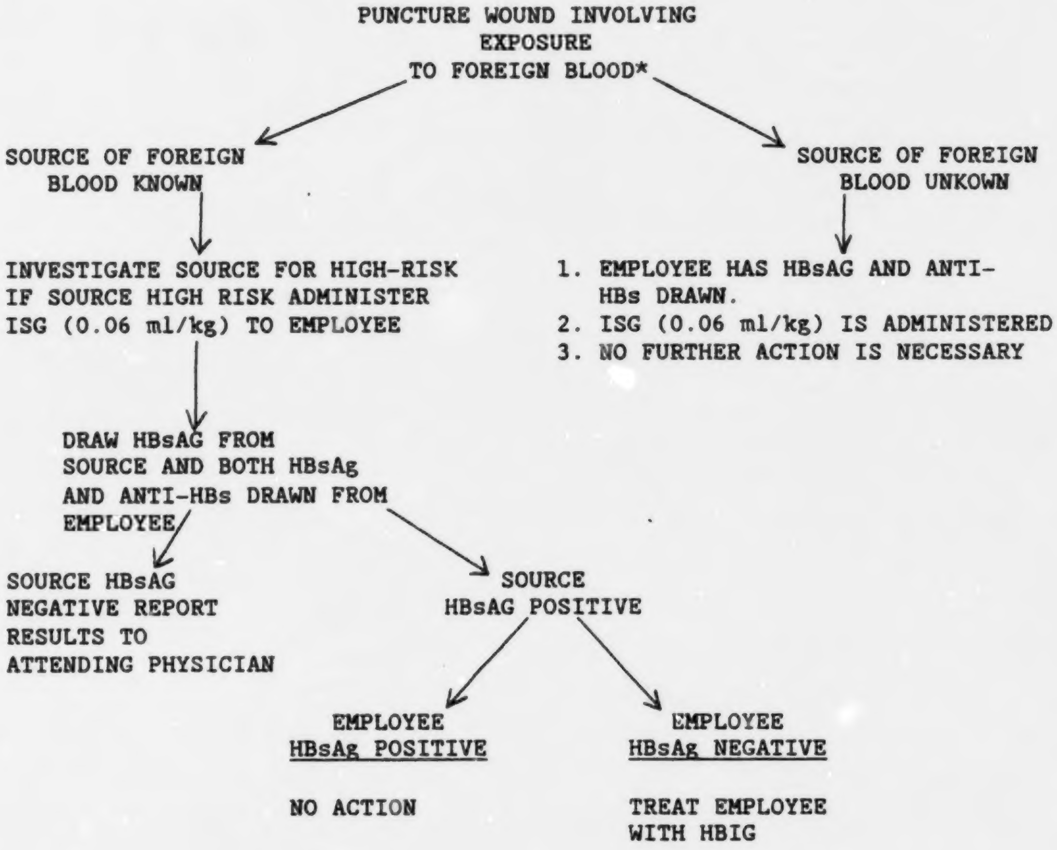
Hygiene is an important factor. All suspected contaminated articles should be disinfected, and dressings and disposable items should be placed in a sealed bag within a sealed bag for incineration only.

Medical personnel should wear protective clothing and disinfect their hands thoroughly. It is recommended that linen should be soaked for twelve hours in a 1.5 percent solution of formalin or boiled for thirty minutes. Contaminated articles should be steamed autoclaved if possible.

3. Medical Monitoring

At the time of employment, those individuals whose prospective work assignment place them at the highest risk, should be tested for hepatitis B. If they are negative, the vaccine should be recommended for protection against this very virulent disease. Any worker who is concerned should be offered the test to establish his state of immunity. As the vaccine becomes more available, it will be offered to more hospital workers.

HEPATITIS B EXPOSURE FLOW CHART


PUNCTURE WOUND INVOLVING EXPOSURE TO FOREIGN BLOOD*
SOURCE OF FOREIGN BLOOD KNOWN
SOURCE OF FOREIGN BLOOD UNKOWN
INVESTIGATE SOURCE FOR HIGH-RISK IF SOURCE HIGH RISK ADMINISTER ISG (0.06 ml/kg) TO EMPLOYEE
1. EMPLOYEE HAS HBsAG AND ANTI-HBs DRAWN.
2. ISG (0.06 ml/kg) IS ADMINISTERED
3. NO FURTHER ACTION IS NECESSARY
DRAW HBsAG FROM SOURCE AND BOTH HBsAg AND ANTI-HBs DRAWN FROM EMPLOYEE
SOURCE HBsAG NEGATIVE REPORT RESULTS TO ATTENDING PHYSICIAN
SOURCE HBsAG POSITIVE
EMPLOYEE HBsAg POSITIVE
NO ACTION
EMPLOYEE HBsAg NEGATIVE
TREAT EMPLOYEE WITH HBIG

NOTE:

HBIG - Hepatitis B immune Globulin
HBV - Hepatitis B virus or Hepatitis B vaccine produces protective antibody
ANTI-HBs - will identify those previously infected except for Carriers
HBsAG - Hepatitis B surface antigen
ISG - Immune Serum Globulin

*Exposure to foreign blood includes not only a puncture wound but also exposure by way of skin break, splash or splattering of blood and of body fluids, especially into the eyes or mucosa or by ingestion.

Flow Chart developed by: Elaine Meighen, Staff Health Nurse, Glenrose Hospital, Edmonton, Alberta.

References

Brown, M.C. et al. "Guidelines for Employee Health Services to Hospitals, Clinics and Medical Research Institutions," Journal of Occupational Medicine 25 (October 1983) : 771-773.

Cooper, I. "Serum Hepatitis - The Occupational Risks," Occupational Health 36 (November 1984) : 487-488.

Dufresne, R.M. "Why Does the Workers' Compensation Board Have to Consider "Hepatitis B"?," Alberta Occupational Medicine Newsletter (Spring 1985).

Pappas, S.C. and M.M. Fisher. "Preventing Hepatitis B in Health Care Workers," Canadian Family Physician 31 (October 1985) : 1941-1944.

International Labour Office. The Encyclopedia of Occupational Health and Safety. 3rd (revised) edition. Geneva : I.L.O., 1983, p. 1032-1034.

E. Tuberculosis (TB)

The bacterium responsible for this disease is mycobacterium tuberculosis. There are other species of mycobacteria which cause pulmonary disease but their growing characteristics are different and they do not appear to be of concern in human Tuberculosis. Mycobacterium bolvus, which inhabits raw milk, may also cause symptoms, but is rarely seen in Alberta. The non-motile mycobacterium tuberculosis reproduces slowly in living tissue and may lie dormat for many years. In culture media, it requires 3-8 weeks to demonstrate colonies.

Man is the chief reservoir in nature for the T.B. bacillus. It is usually transmitted by the airborne route, but on rare occasions it can be ingested (eg: raw milk) or enter the body through open skin or accidental injection such as in a laboratory.

1. Pathogenesis

Five distinct processes usually occur in tuberculosis: implantation, multiplication, dissimination, cell mediated immune response, and healing.

Implantation takes place in the tissues of the alveoli, usually in the part of the lung which receives the best ventiliation.

Multiplication takes place at the sight of infection. It may reproduce unhindered as sensitivity to the bacillus takes several weeks.

Dissemination takes place when the baccilli enter the blood and lymph systems and spreads the infection to other parts of the body. The receiving site may be the brain, kidney, and growing bones, but this is uncommon. These infected sites may show immediate progression of the disease or reactivate months or years later.

Cell mediated immune response begins to combat infection after several weeks. Immunity begins with the sensitization process: the lymphocytes from the thymus gland begin to specifically react to the baccilli. These lymphocytes concentrate around each focus of infection destroying the baccilli and slowing their rate of reproduction. This is why infected persons react positively to the mantoux.

With healing, following the lymphocyte activity, a granuloma is formed around the infection composed of fibrotic tissue which later becomes calcified.

2. Control of Hazards

a) Isolation

Isolation precautions are put in place in the case of an active T.B. patient who is potentially the transmitter (persons who cough or have very positive sputum smears with acid-fast T.B. baccilli and are not on chemotherapy or have poor response to chemotherapy). The person must be in a single room or share with a diagnosed patient only. The ventiliation must be such that it is not possible to spread by way of air flow. The patient must be taught to use superior hygiene including frequently covering his mouth with tissue. These tissues should be carefully disposed of. Staff and visitors must wear masks and often the patient as well. Staff must practice good hygiene, and adherence to pertinent housekeeping principles must be strictly maintained. No special precautions are necessary when handling dishes, laundry, bed clothing or personal effects.

Check recommended O.R. procedures before undertaking surgery.

The hospital infection control committee should be aware of the frequency of T.B. in the community. Statistics should be kept to govern the frequency and target of screening for staff and patients.

b) Screening Methods

History of exposure is the first clue to look for, then the frequency of occurrance of T.B. in the community from which the individual comes.

Mantoux tests, which are read or assessed 48 hours after the intradermal injection is given, indicates if antibodies to the T.B. baccilli are present. The degree of induration and redness indicates the degree of reaction. Individuals with positive reactions are given a chest x-ray. In the case of a known exposure when the mantoux is negative, the mantoux should be repeated 2-3 months after the exposure to allow the antibodies to the T.B. baccillis to build up sufficiently for a reaction to occur.

X-rays are paid for by the Alberta Health Care Insurance. Failing a AHCI number, the cities of Edmonton and Calgary will pay for x-rays taken at T.B. clinics in their cities.

c) Guidelines for Staff Surveillance

Every hospital is responsible for having a worker T.B. surveillance program:

i) Except for previously documented positives, a tuberculin test mantoux for all workers should be done at the time of hiring during the pre-employment physical examination and health history interview.

ii) If the reaction of the first test is less then 10 mm in duration or negative, a second test should be given at least 1 week and within 3 weeks after the first test.

d) Positive Reactors

i) Should undergo further investigation to rule out active disease; this should include chest x-rays, urine examination and cultures as indicated.

ii) Chemotherapy should be offered when indicated.

iii) Positive reactors should be reassessed annually for 2-3 years; with inquiry for symptoms, chest x-rays and cultures as indicated.

iv) If there is a positive reaction to the mantoux and the candidate had BCG, the tubercular status should be established at time of employment. If the candidate has not been tested within the last 5 years, do routine T.B. test and follow with an x-ray if the mantoux is positive. Reassess for positive reactions.

e) **Negative Reactions**

Reassess staff annually.

Staff in high risk hospital areas should be reviewed every 6 months.

f) **Contact Follow-Up**

Contact follow-up is indicated when there has been an inadvertent exposure to a potential transmitter. Staff who directly dealt with the patient or colleague on a relatively close basis should be assessed .

i) Immediate T.B. skin testing if the contact was previously negative.

ii) If he remains negative, he should be retested 3 months from the time of exposure.

iii) Previous positive reactors (including those who had BCG) and new positives should have chest x-rays immediately, with inquiry for symptoms, and cultures as indicated. High risk individuals are those who share the same air space with the source case over a prolonged period of time: the risk decreases as proximity and length of time the air space is shared, decreases.

3. Legislation

Tuberculosis Services operates as part of the Communicable Disease Control and Epidemiology Division of the Department of Social Services and Community Health of Alberta. The Director of Tuberculosis Services has over all responsibility for T.B. control in the province. T.B. services must work closely with the Local Health Units, Local Boards of Health and private physicians. Close co-operation and a good working relationship with all concerned parties is essential.

References

Alberta Social Services and Community Health. Tuberculosis Control in the Province of Alberta. [Edmonton] : The Department, 1982.

IX. RADIATION

There are many sources of ionizing and non-ionizing radiation in a hospital. Both types must have a hazard monitoring system. The equipment must meet the Federal and Provincial electrical and radiation standards. All radiation devices are to be registered with the Alberta Radiation Health Branch in accordance with the Alberta Radiation Protection Act. Personnel who use this equipment should be aware of the hazards and safeguards.

Non-ionizing radiation occurs in the operation of microwave ovens, blood warmers, ultrasonic cleaning equipment, ultraviolet and infrared lamps and laser devices. Although the damage they create is superficial and localized, it can be very serious.

Ionizing radiation is produced from x-ray equipment and radioisotope, for therapeautic and diagnostic procedures. It can cause superficial harm or penetrate for deep damage. Rapidly growing cells are permanently harmed, examples are the embryo or tumors.

The installation, shielding, maintenance and calibration of equipment by a qualified person is basic to its safe use. The operator should be well trained. Everyone who works near a source of radiation must be aware of the safety precautions.

A qualified radiation safety officer should be appointed and made responsible for policies, practices, and safety related to radiation in the hospital. This would include supervision of the monitoring program in place. (S)he should be in a position to consider for approval all requisitions for equipment and for radioactive materials.

A. Ionizing Radiation

Ionizing radiation ionizes and excites atoms in the body resulting in chemical changes in the cells. This may result in genetic damage or somatic injury. The source of radiation may be external as produced from x-ray equipment, or may be internal if the source is injected, ingested, inhaled or absorbed, for example substances used in thereauputic or diagnostic nuclear medicine.

Objectives of Radiation Protection

To prevent or minimize somatic injuries and the deterioration of the genetic constitution of the population.

To ensure that no person is exposed to ionizing radiation that is in excess of statutory or recommended limits (maximum permissible dose), and to keep exposure as low as reasonably achievable.

Protection from Ionizing Radiation

Reduction of the length of time spent near the source.
Increase the distance between a worker and the source.
Interpose a shield of dense material between the worker and the source.

Medical Surveillance for Radiation Workers

This standard applies only to those personnel working with x-rays or with nuclear medicine sources. Personnel are required to use radiation monitoring badges.

The pre-employment examination is to establish a baseline of normality for the individual, and to identify existing conditions, particularly those of occupational origin. In this way it should be easier to detect deviations from normal, after an accident or during the routine periodic evaluation. Fitness for the job is similar to other positions involving responsibility and patient contact.

Attention should be paid to occupational history especially exposure to radiation, toxic dusts, chemical fumes and skin damage. Records should include any history of blood transfusions, cataracts, chemotherapy, or medical exposure to radiation including radiation therapy and a family history of leukemia or cancer.

The physical examination should investigate symptoms of chronic skin disease, especially the hands. Eye examination should involve looking for early cataract development. Complete documentation of these points is important.

Blood work recommended:

- Erythrocyte sedimentation rate
- Hematocrit
- Haemoglobin
- White blood count and differential

The following conditions would preclude working in this particular area:

> Aplastic anemia, hemolytic disorders, leukopenia of unknown causes and leukemia.
>
> Changes in peripheral blood count until a basis for the change has been established, e.g. megaloblastic anemia.

The following conditions require discretion and an individual decision:

chronic skin diseases especially dermatitis of the hand;
cataracts or changes in the lens.

In summary the purpose of the medical examination is to exclude those who have conditions which could be worsened by radiation exposure. It is necessary to have baseline records to assist in establishing if medical conditions which could develop later are caused by employment.

All accidents and high exposures will be investigated by the Radiation Protection Officer and appropriate medical follow-up recommended. Medical examinations after accidents may include a complete blood examination, cytogenetic analysis, bioassay including urine monitoring for radioisotopes and whole body counting in the case of suspected ingestion of radioactive isotopes.

1. X-Rays

a) Control of Hazards:

i) Engineering Controls

Equipment is to be calibrated on a regular basis and after modification or if tubes are replaced. X-ray Equipment must be checked before and after use.

Lead is an effective barrier and is used to line walls, for personal protective equipment and in glass windows.

ii) Personal Controls

Personnel must be sure that they are being shielded, preferrably in a booth, if not in a booth then by wearing lead lined aprons, gloves, thyroid collar or goggles. Pregnant personnel should be careful to avoid exposure or to use correct shielding.

The area should be monitored periodically to discern what the radiation levels are.

Protective devices like collars, aprons and gloves must be carefully handled and checked regularly for cracks to allow possible leakage of radiation.

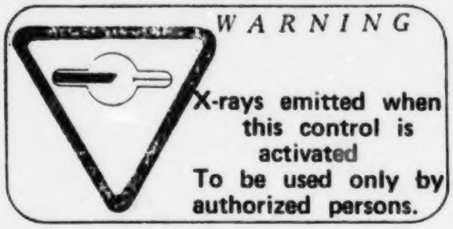
Dosimeter badges must be worn by all staff who work in the Radiation Department. The badges are sent to Ottawa to be analyzed and the readings recorded and returned to the Radiation Protection Officer. Personnel are kept informed of their radiation levels.

Dosimeters should be properly stored when not in use to prevent false readings.

iii) Administrative Controls

If a dosimeter badge shows exposures over the limit, an investigation is made and that worker may require temporary reposting to an area removed from the radiation sources until his radiation exposure is within acceptable limits.

X-RAY WARNING SIGN


WARNING
X-rays emitted when this control is activated
To be used only by authorized persons.

readily discernable

the symbol is black
and white on a white
background with a
yellow border

permanently affixed
to the device

no outer dimensions
less than 2 cm

bears the words
"caution-x-rays"

b) **X-rays Using Portable Equipment**

Portable x-ray equipment is a possible hazard to nursing and auxiliary staff as well as to the radiology staff. Documentation of the numbers of x-rays taken in a populated room such as I.C.U.'s and OR's should be kept in order to have some indication of the need to monitor the cumulative radiation exposure. Based on this documentation, dosimeters could be used to assess the radiation exposure to staff. The operator of the equipment must wear a dosimeter. The number of personnel in the room must be kept to a minimum and have proper shielding during exposures.

c) X-Ray Legislation

Design, Manufacture and Sale: Federal Radiation Emitting Devices Act.

Installation, Use: Provincial Responsiblity

i) Radiation Protection Act, 1980

ii) Regulations under the Radiation Protection Act: Regulations Respecting the Installation and Use of Medical, Dental, Veterinary and Paramedical X-Ray Equipment, Alberta Regulation 181/72 with amendments up to and including Alberta Regulation 242/72.

2. Nuclear Medicine

All radioactive medicine comes under the Atomic Energy Control Act and therefore is subject to the regulations set out in this Act. In order to use radioactive materials, an institution must be licenced by the Atomic Energy Control Board (AECB). This licence grants the institution the right to buy, use and dispose of radioactive drugs. As some of the packages emit radiation, it is good policy to have them reach the Nuclear Medicine Department as swiftly as possible. Under no circumstances should a container of radioactive materials ever be left unattended or kept in a populated area.

Staff health is safeguarded when all reasonable steps have been taken to ensure the security of these drugs, that no drugs have been misplaced to present an inadvertent hazard. A major responsibility in handling radioactive medicine is that the institution is responsible for knowing where all the material was used, discarded or administered. All steps possible must be taken to ensure the safety of these drugs.

a) Therapeutic Use of Radioactive Materials

In this use of radioactive material or radioisotopes, the radiation delivers a tumouricidal dose to a specific target of rapidly growing cancer cells and at the same time gives a very small dose to surrounding healthy tissue. The radioisotopes can either be placed in the affected area or, because of their specific nature, physiologically locate in the target organ. Isotopes for therapy may be sealed or unsealed. The sealed types can become displaced. The unsealed type may contaminate linen, hospital utensils or hospital personnel. Once the sealed material or implant has been removed, the patient no longer emits radiation and can be treated like any other patient. The activity of the unsealed source will gradually decay within a predictable time period. The Radiation Protection Officer will periodically monitor the extent of decay and notify the staff when a patient is no longer considered radioactive.

b) Control of Hazards for Therapeutic Radioactive Materials

i) Engineering Controls

Appropriate signs should be posted on the doors of rooms housing patients receiving radiation. Specific instructions as necessary should be nearby for staff and visitors.

Equipment appropriate to the methods utilized should be available such as lead container, long handled forceps, log book and gloves.

ii) Administrative Controls

Policies and procedures for patient care and room cleaning should be in place to minimize staff uncertainty about exposure. These will vary with the treatment substance. The Radiation Protection Officer should be available to be consulted for advice in any unusual circumstance.

iii) Personal Control for Therapeutic Radioactive Material

Careful personal hygiene is to be observed by everyone entering and leaving the patient's room. Workers should comply with policies regarding their health and safety during the treatment and care of the radiation patient.

c) Diagnostic Nuclear Medicine

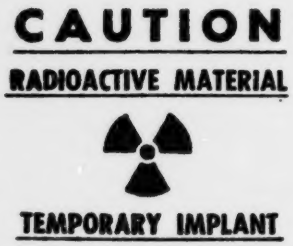
Diagnostic nuclear medicine is the administration of radioactive drugs to the patient for the purpose of locating disease or abnormal conditions. The radioactivity remains with the patient until either the material is excreted or until the radioactive isotope decays to a non-radioactive form. The length of time and the amount of radiation emitted is determined by the type of isotope used and its physical half-life, the mode of administering its chemical form and the physical state of the patient. The amount of radiation involved is minimal and is not considered to be a hazard. The worker, however, should keep himself aware and try to minimize cumulative exposure. Radiation signs should be posted in the area. The worker working in the area of diagnostic radioactive isotopes must observe careful personal hygiene.

i) Precautions When Caring for Patients Receiving a Diagnostic Dose of Radiation

These patients emit radiation. They should not stay in the department any longer than necessary and should sit with other radiation patients when possible, away from the area where staff and non-radiation patients might congregate. Pregnant staff should avoid contact. Materials used should be documented on the chart of the patient. This will be a guide to the possible exposure of staff.

Precautions should be taken by staff with skin punctures or cuts when the more toxic radionuclides are being handled. A bandage is insufficient protection, gloves should be used or the worker relocated.

Rooms containing radiation sources should be properly marked. Only authorized personnel should be allowed in the area. All workers should recognize the radiation symbol:



shaded area is
purple (magenta)
or black

background is
yellow

d) **Nuclear Medicine Legislation**

Federal control only, at both the manufacture and sale, and the use stages.

i) Atomic Energy Control Act.

ii) For questions or further information contact: Radiation Health Branch, 10709 - Jasper Avenue, Edmonton, Alberta, 427-2691.

References: Ionizing Radiation

Clever, Linda, H. Designing a program that works. Occupational Hazards to Health Care Workers: Research and Prevention (Conference). University of Washington, Seattle, Washington, May 1983, p. A-5.

Canada. National Health and Welfare. Course Manual, Radiation Control in Hospitals. Ottawa : The Department, 1970.

Canada. National Health and Welfare. Radiation Hazard Control in Hospitals. Ottawa : The Department, 1971.

Douglas, G. et al. Radiation Protection Policy Manual, Calgary, 1980.

Ontario Hospital Association. Occupational Health & Safety Manual for Health Care Institutions. Don Mills : Ontario Hospital Association, Occupational Health & Safety Services, 1977.

Howe, H. F. Organization and Operation of an Occupational Health Program. Chicago : Occupation Health Institue, 1975.

Lewy, R. "Prevention Strategies in Hospital Occupational Medicine," Journal of Occupation Medicine 23 (February 1981) : 109-111

Lewy, R. Hospital Occupational Medicine. Prescription for Change, Occupational Hazards to Health Care Workers: Research and Prevention (Conference), University of Washington, Seattle, Washington, May 1983.

World Health Organization. Manual on Radiation Protection in Hospitals and General Practice. Vol. 1. Basic Protection Requirements. Geneva : W.H.O., 1974.

World Health Organization. Manual on Radiation Protection in Hospitals and General Practice. Vol. 2. Unsealed Sources. Geneva : W.H.O., 1975.

World Health Organization. Manual on Radiation Protection in Hospitals and General Practice. Vol. 3. X-ray Diagnosis. Geneva : W.H.O., 1975.

B. Non-Ionizing Radiation

1. Laser

Laser is an acronym for Light Amplification by Stimulated Emission of Radiation. An input source of energy passes into a lasing medium, and a very coherent beam of energy is emitted. The laser beam is close to one wave length of color, is very intense and does not diverge. Optical lenses can cause the beam to diverge or converge.

The use of lasers in medicine is considered to be a major change affecting the quality and scope of medical care. Laser surgery is a relatively new technique, and due to advances in design and applications, new uses are quickly developing. The special type of laser energy can be focused to develop the very high power necessary to cut, coagulate, or vaporize tissue.

Most hospital non-medical laser systems are in a closed atmosphere and if well maintained and routinely monitored, present little hazard to staff. All lasers, however, should be registered with the province of Alberta Radiation Health Branch (Section 4, A.R. 45/73) and the hospital radiation safety committee. An equipment maintenance routine must be clearly laid out.

With respect to power and safety the laser and laser systems are considered to fall into one of four classes:

Class I - essentially a safe lower powered laser, not capable of emitting hazardous laser radiation under any operating or viewing conditions (The old "Class V" because of its safe housing is considered to be in this category).

Class II - device in the visible frequencies. The only danger is from staring into the direct beam, momentary exposure is not considered hazardous.

Class III & Class IV - the medium and high powered lasers. They are the most dangerous and as such carry the most stringent safety requirements. Most surgical applications fall into these classes.

a) Medical Applications

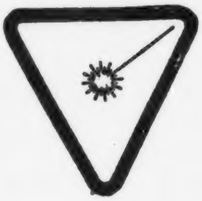
Lasers are used in eye surgery and for superficial treatments such as removal of warts, tattoos, or tumors. With the help of fibre optics, lasers can penetrate deeper tissue to treat gynaecological, bowel and bladder cancer. New applications continue to emerge.

b) The Hazards of Lasers System

As the laser can therapeutically coagulate or vaporize a patient's tissue, so it can accidently damage the tissue of a staff member. The critical organs are skin and the eye. The lens of the eye can intensify the visible and near infrared wave lengths to increase the amount of damage done. Any damage is irreversible.

c) Protection

With Class III & IV the main beam is the primary hazard. Prevention or protection from reflections must also be considered. Altering time and distance factors are of limited value, only shielding is safe. Effective body shields and goggles or eye shields of appropriate optical density are required when near an operating laser. The sunburst symbol refers to the presence of lasers. It is used with other information on the particular laser to convey the safety requirement for that laser.



d) **Control of Hazards**

i) **Education**

All O.R., clinical and servicing personnel who are likely to be present during laser operations or maintenance are required to attend training sessions. The sessions describe the principles of operating lasers, the uses and risks to patients and staff, safety procedures and care of equipment. A trained laser technician should have the responsiblity for setting up and putting away the laser before and after use.

Surgeons should be trained in laser use and certified by the hospital for each type of procedure.

ii) **Safety Procedures**

There should be a safety committee with the responsibility for all laser activity within the hospital. The members must have definite areas of responsibility and must be accountable in promoting and maintaining all aspects of laser safety. They should report to the Radiation Safety Officer.

iii) **Engineering Controls**

Good local exhaust to remove airborne contaminants from the laser surgery.

Warning signs must be in place when lasers are in use.

There must be safety locks to prevent inadvertent user exposure; and a remote interlock to be turned on before operating the laser.

There must be visual and auditory warning that is activated shortly before laser emission to warn personnel to avoid the beam path.

Microscopes to have a fail safe mechanism to prevent reflecting stray beams.

A limiting mechanism in all viewing optics to control the amount of laser energy that can reach the user's eye.

iv) Personal Controls

Careful room preparation with recognition and removal or covering of reflecting surfaces, as necessary.

Preparation of endotracheal tube; non-reflecting, non-combustible and the cuff to be filled with water in case of fire from inadvertent exposure to the beam. Pre-operative checking and verification of the laser by the trained technician according to manufacturer's recommendations.

Pre-operative check by the physician of the focusing and limits of power range for the planned procedure.

The laser is never to be switched on to operating mode until surgery is ready to commence.

It is locked when not in use and the key removed.

The anaesthetist and physician must be aware of recommended methods for safe delivery of anaesthetics during laser surgery.

Flammable anaesthetics must be avoided.

All staff are required to have eye wear of the correct optical density for the particular laser in use.

e) Medical Monitoring: Laser Workers

Preplacement and periodic eye examination are to be done for the particular laser in use (Section 11,12, AR 45/73).

f) Non-Ionizing Radiation Legislation

A provincial responsiblity: Radiation Protection Act:

i) Regulations Respecting the Protection of Persons from Hazards of Laser Operation. Alberta Regulation 45/73.

References: Lasers

American National Standards Institute. American National Standard for the Safe Use of Lasers, ANSI Z136:1-1980. New York : ANSI, 1980.

Fisher, J.C. "A Program for Ensuring the Safe Use of Lasers in Surgery and Therapy," Bio-Laser News (January 1985) : 2-5.

Sliney, D. and M. Wolbursht. Safety with Lasers and Other Optical Services, A Comprehensive Handbook. New York : Plenum Press, c1980.

2. Ultraviolet Light

Ultraviolet light has low penetrating properties. The main source of ultraviolet light is sunlight.

a) Biological Effects and Hazards

The critical organs are the skin and eyes. The effects on the skin can be either acute or chronic. Acute effects are rapid onset with short duration, with symptoms similar to a sunburn with erytherma. The chronic reactions are skin aging and skin cancer.

Eye reactions can be acute with conjunctivitis and photokeratitis or chronic with possible cataract formation.

Ultraviolet is cold light and there is no immediate sensation of burning. The effects on the skin and eyes are wave length dependent. Shortwave ultraviolet radiation plus oxygen can create ozone, a colorless, toxic, irritant gas.

b) Application

Skin diseases such as psoriasis and acne are treated with drugs plus ultraviolet light, also superficial ulcers, neonatal jaundice, pruritus; skin diseases such as ringworm, erythrasma and infections from burn wounds. Ultraviolet light is used by dentists to identify cavities and for polymerisation. Ultraviolet light is bactericidal and is used for sterilization.

c) Protection

Time, distance and shielding, mainly shielding: screens, suitable safety glasses, gloves and clothing (any opaque material). The sunscreens containing PABA (paraminobenzoic acid) are very effective. Awareness is key.

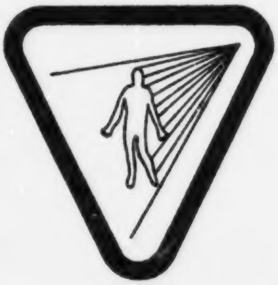
d) Control

There are a number of methods of detecting ultraviolet light. These include film, photoelectric cells and chemical changes. U.V. radio meters now available are a direct reading instruments which use opto-electronic detectors. As with other sources of radiation, maintenance and calibration procedures must be in place and followed.

e) Legislation

There are no provincial regulations for ultraviolet light. Federal regulations are available for sun lamps and guidelines for manufacturers of dental appliances. For practical protection and monitoring the NIOSH/ACGIH standards are used. The federal department recommended warning signs as follows:

Ultraviolet warning symbol:



Reference

Diffy, B. L. "Ultraviolet Radiation in Medicine," Medical Physics Handbook 11. Bristol : Adam Hilger Ltd., 1982.

3. Shortwave and Microwave Devices

Used to produce local heating in biological tissue for the conversion of electro-magnetic energy into thermal energy.

a) Applications

Microwave ovens, blood warmers, diathermy devices in physiotherapy.

b) Health Hazards

High intensity fields could exist around these devices which could be hazardous to the operator. It is essential that such exposure be monitored and eliminated.

c) Biological Effects

There seems to be a consensus among scientists that effects are thermal in nature. The critical organs, particularly susceptible to heat, are the eyes and the testes. The type of eye injury depends on the frequency, for example millimetre waves can produce keratitis. Cataracts will develop after sufficiently long exposure to power densities above 100 mW/cm^2. The effect on the testes from high intensity fields and thermal energy is retarded spermatogenesis, it is reversible. It is very controversial but there has been some indications from the U.S.S.R. and supported by animal studies in the West, of behaviour disruption due to exposure to low frequency radiation. Recent studies of possible synergistic effects of radio frequency exposure and various drugs have produced a highly inconsistent picture. A list of possible adverse effects reported for shortwave and microwave diathermy is on pages 23-24 of the Canada-wide Survey Part I.

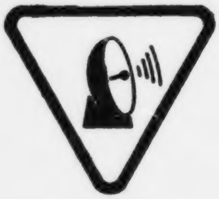
d) **Protection**

Protection factors are the reduction of exposure, increased distance from the source, and shielding. Recognize the Canadian microwave warning signs. The effect of microwave radiation is not cumulative. Recommended maximum exposure levels in Canada are listed on pages 7 and 8 of the Shortwave Diathermy Guidelines for limited radio frequency exposures.

e) **Control of Hazard**

Devices should be regularly serviced. Only 43% of the Canadian facilities using diathermy that were surveyed had the devices calibrated. In approximately 62% of responses in the survey, calibration was done at less than annually. The guidelines recommend thorough examination of diathermy devices at least yearly to ensure that all parts are in good working order. Particular care should be taken to ensure that cables and electrodes are not cracked or burned and hinges of the applicator (electrode) support are working properly. The recommendations provided in the Guidelines, p.12, address only those aspects dealing with the radio frequency exposure for shortwave diathermy devices and do not deal with electrical safety rules. These must also be considered. Manufacturers' instructions on equipment should be followed. If in doubt ask a qualified person to check.

Testing for the electro-magnetic field around the equipment is relatively simple, gases in a fluorescent tube will glow when placed in a high field of activity. Another more complex test can be done by measuring the temperature rise around the device.



CAUTION MICROWAVE RADIATION

f) Legislation

Microwave ovens are regulated under the Federal Radiation Emitting Devices Act and specify design and function standards, including leakage levels of new ovens. There is no formal provincial control over new installations. The Radiation Protection Bureau of Canada Health & Welfare is investigating effects. In the conclusion of the Canada-wide survey of non-ionizing emitting devices, the final paragraph states that a further study to assess the potential health hazards of shortwave diathermy devices is indicated. If health hazards are identified, new guidelines or regulations will follow.

For further information contact: Radiation Health Branch, 10709 - Jasper Avenue, Edmonton, Alberta, 427-2691.

References

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Canada. National Health & Welfare. Canada-wide Survey of Non-Ionizing Emitting Medical Devices Part I - Shortwave and Microwave Devices. Ottawa : The Department, 1980.

4. Extremely Low Frequency (ELF)

ELF is defined as electro-magnetic radiation with frequencies in the range of under 0 to 100 Hz, which has a wavelength of greater than 3000 kilometres. The biological effects of the electric and magnetic fields are currently undergoing intensive research to determine their significance to the health and safety of workers and general public.

a) Applications

Applications are developing. One of current interest is to promote bone healing.

b) Detection

Equipment is available.

c) Protection

Time and distance. Electrical fields are easier to shield against than magnetic fields. There are come countries that have recommended protection standards.

Reference

Sheppard, A. and M. Eisenbud. Biological Effects of Electric & Magnetic Fields of Extremely Low Frequency. New York : University Press, 1977.

5. Ultrasound

Ultrasound is a form of mechanical energy with frequencies above the hearing range (20 kHz). This acoustic radiation is usually categorized with the non-ionizing form of radiation because it doesn't cause ion pairs to be produced in the irradiated material. Sufficient evidence is available of the harmful health effects from exposure to ultrasound to suggest a cautious approach in its use.

a) Biological Effects

It is commonly believed that ultrasound is a radiation which, in lower beam intensities, can be used with complete safety. However, subtle and delayed effects from low level exposures which have not been identified for study may exist. The Bureau of Radiological Health of the U.S. Department of Health & Human Services cautions that sufficient evidence now exists to issue a warning against indiscriminate use of diagnostic ultrasound. For a list of biological effects from the research material published about ultrasound, see pages 13 and 15 of this same publication, "Guidelines for Safe Use of Ultrasound".

b) Applications

Therapeutic use: the objective of such treatment is usually to stimulate the blood flow within the injured regions to provide deeper heating to muscles than can be obtained using a superficial heating device such as a heat lamp.

Diagnostic ultrasound is generally considered to be an indispensible diagnostic tool in neurology, cardiology, obstetrics, ophthalmology and other areas of clinical medicine.

Dental uses are many and varied from cleaning to surgery and root canal therapy.

c) Hazards

Ultrasound is generally accepted as an indispensible diagnostic tool and the possible associated risks have not been completely evaluated because the *"bioeffects"* may be of a subtle nature. Past human epidemiological studies have yielded inconclusive results. The Guidelines publication states that it will be several years at least before definitive data is available from ongoing and future epidemiological studies.

Hazards to trained operators following safe use guidelines have not been stated.

d) Control of Hazards

i) Care of equipment - a trained technician or the device manufacturer should calibrate at least once per year.

ii) Maintenance - Ultrasound devices should be given a complete safety check yearly to ensure that all parts are in good working order.

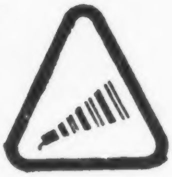
iii) Testing of the applicator should be done in the recommended manner.

iv) Use of ultrasound equipment - During the use of ultrasound equipment, operators should minimize potential exposure to themselves. It is recommended that all operators of ultrasound devices have received a course which includes the use of ultrasound devices, its implications, the contraindications of use and introduction to possible ultrasound bioeffects. A sound knowledge of anatomy, particularly surface anatomy and physiology is essential. Potential operators require a course in ultrasound therapy. They could be qualified nurses, medical practitioners and physiotherapists.

e) Protection

For personal safety, avoide any unnecessary exposure to the direct ultrasound beams, especially at the higher intensities.

Ultrasound Warning Symbol:



References

Canada. National Health and Welfare. Guidelines for the Safe Use of Ultrasound Part 1. Medical and Paramedical Applications. Ottawa : Health and Welfare, Ottawa : National Health and Welfare, Environmental Health Directorate, Health Protection Branch, 1980.

Canada. National Health and Welfare. Canada-wide Survey of Non-Ionizing Radiation Emitting Medical Devices. Part II. Ultrasound Devices. Ottawa : National Health and Welfare, Environmental Health Directorate, 1980.

X. SHARPS

A study from one hospital shows that the hospital staff most likely to suffer needle prick injuries listed in the order of most frequent to least are: trained nurses, housekeeping, portering staff, student nurses, miscellaneous, including medical staff, nursing auxiliaries and laboratory staff. The most frequent occasions were during the collection of waste, followed by needle disposal, during injections, clearing used trolleys, resheathing needles, picking up needles from the floor and obtaining catheter specimens. Other needle-prick situations in declining order of frequency were: removing intravenous catheters, accidental innoculation of vaccine or other substances, phlebotomy, or injecting phlebotomy drugs through infusion set.

Needle pricks are only one way to sustain a *"sharps"* injury. Faulty disposal of scalpel blades and lacerations from broken glass or sharp objects, bites or scratches produced the similar injuries, in hospitals, with a strong possibility of infection secondary to the initial injury. For immediate treatment to avoid Hepatitis B infection, see the flow chart for *"sharps"* injuries (page 3-68).

In the article, *"Sharps Injuries in the Hospital"*, the occupational health nurse gives several suggestions for avoiding sharps injuries:

1. Education of all staff from nurses to housekeeping, to physicians regarding inherent hazards of *"sharps"* injuries. Included would be an emphasis on the responsibility of the user to dispose of sharp waste safely into the container provided for that purpose. Posters can serve as reminders.

2. Correct procedures to be utilized: needles are not to be resheathed; housekeeping may request nurses to pick up sharps from the floor; needles should be removed from syringes with forceps. The dismantling of an unused trolley must proceed with caution. Hands should not, for any reason be put inside disposal

sacks, nor should garbage be transferred from one bag to another. All puncture wounds should be carefully washed and disinfected, and reported.

3. Injuries should be reported by all staff to management and an accident form is to be completed and filed. When accidents occur, strategies for avoiding similar incidents must be explored.

The tragedy of sharp injuries is that they are so preventable. Only the application of safe procedures and the availability of a proper disposal container is required.

Reference

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XI. STRESS

Although stress is part of life, it is not necessarily all bad. Dr. Hans Selye, world authority on stress, makes it very clear that stress is *"the very salt and spice of life"*. Without any stress in our lives we would simply vegetate.

Three basic kinds or stress operate in our lives:

- The stress which results from a sudden and serious event, such as a car accident or the sudden death of a loved one.
- The stress that comes with a particular stage of life; marriage, childbirth, the onset of middle age or retirement.
- Stress that becomes an ingrained part of daily living - until we do something to change the pattern.

Stress becomes DISTRESS when too much happens too fast. When life deals out too much at one time, we lose our sense of perspective. We begin to spend our precious lifetime reacting to circumstances that have been thrust upon us. We *"can't cope"*.

A. Understanding the Hazards:

According to Calhoun, current studies support the fact that dysfunctional stress will result in a lower productivity, higher absenteeism, loss of work time from disease, premature death, increased accident rates, higher job turnover, increased work errors, narrowing of attention resulting in poor judgement and problems that spill over into home life.

There are two popular misconceptions about coping with stress.

- Learning to cope is for Superman/woman only. No one is ever in a position of total control, able to predict all difficulties and find instant solutions to all problems, because so much depends on the actions and attitudes of others. Fate throws in its own surprises, too: sudden death, loss of a job, injuries, illness, and so on.

- Another myth is that coping is just *"hanging in by the fingernails"*. Coping is not mere survival. Translated into everyday life situations, coping becomes a matter of dealing well with life's stresses and strains. Not dominating them. Not being overwhelmed by them. It's a matter of meeting the challenges as and when they arise. It's a matter of balance.

Stress can become an ingrained part of daily living unless a conscious effort is made to deal with it.

B. Hospital Stress

Stressors are found in every part of life but there are stresses which are unique to the hospital workplace. Working in an hierarchial system, dealing with people who are sick, suffering and sometimes dying, shift work and the need to maintain harmonious working relationships with other disciplines and departments can all produce stress. In addition, each person has personal stresses from home, family, etc. Since stress is an integral part of the job, methods for coping must be developed.

C. Control of Hazards

Preplacement screening offers an opportunity to discuss stress and how the worker presently copes with it, and to suggest other potential sources of help if needed.

A clearly defined job description provides each hospital worker with a distinct concept of his job performance expectations. After a thorough training for the job, he must feel confident about a healthly and safe means to acomplish it, followed with an indication of appreciation for *"a job well done"*. Continuing in-service updating is an important element in achieving job confidence.

Because of the nature of hospital work there is a relationship of interdependence of one job to another. The smooth functioning of one area requires a job well done in another. The interdependence can be stressful. To avoid this, an appreciation of the interdependence must be developed, there must be an understanding of the restraints and demands the other areas are under. There also must be someone in a position senior to the two potentially conflicting areas who is interested in sorting out priorities to a satisfactory conclusion.

The attitude and relationship with the supervisor is crucial to controlling stress. Supervisory staff must be aware of motivation and feelings. The workers in a hospital are often drawn into the job for altruistic reasons. This type of person is very likely to *"over demand"* on himself and is a prime candidate for *"burn out"*. Much of the sources of stress listed on earlier pages of section one reveal the potential for varying degrees of *"burning out"*. When symptoms are observed by supervisory staff, the first solution is to ensure support. A sense of objectivity needs to be developed. Some people more than others need to be encouraged to enrich their outside lives, preferably with an emphasis on physical activity. Supervisory staff guidance is an invaluable asset in discovering the *"burn out"* and then in assisting the worker to manage it.

Other outward solutions are: use of flextime and/or shorter workweeks; job enrichment; rotate workers out of high-stress areas; have available a quiet area; reduce overload by redistribution and delegation; give workers a voice in planning and decision making; utilize an integrated team approach for training and sharing responsibility; provide a proper working environment (with the recognition of the factors of heat, cold, ventilation and noise). An uncomfortable working environment contributes to stress. If stress can be minimized, job performance will be at an improved standard.

Other suggested solutions are self-renewal activities such as the ability to get away to a private, quiet area, taking periodic extended vacations, compartmentalizing work from non-work life and changing to non-work or play activities during the workday. General health practices are important: attention to proper diet, sleep, and rest, and regular physical exercise. But this is often not enough, more control over life's situations can be achieved through studying and practicing relaxing techniques such as progressive relaxation leading to deep muscle relaxation and meditation. Hypnosis, yoga and autogenic training can be applied to bolster personal coping strategies. Outside help can be developed with peer group, emotional support systems, and by exploring biofeedback and sensitivity training and family counselling with a staff psychologist, psychiatrist, or a social worker. Even drug therapy is a possibility with muscle relaxers or anxiety reducers and the enhancment of nutrional intake with appropriate vitamin therapy.

In recognition of the stress of hospital work, in-house programs could be planned. If workers are generally aware of the symptoms and motivated to work out solutions, there are many books and programs to assist in alleviating this common psychological hazard. Some of the more helpful books and articles are listed at the end of this section. Relaxation tapes are recommended but must be individually assessed. It is most important to realize that stress can be controlled.

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National Institute for Occupational Safety and Health. Physiological & Psychological Aspects of Night and Shift Work. Cincinnati : NIOSH, 1978, pp. 78-113.

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Selye, Hans. The Stress of Life. 2nd edition. New York : McGraw-Hill, 1956, 1970.

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D. Employee Assistance Program (EAP)

An organized employee assistance program creates a problem solving educational approach to working with the troubled worker in industry (hospital and otherwise). Such programs assist workers to effectively resolve problems of a personal or work related nature, thus minimizing job performance problems and resulting in improved functioning, productivity and personal satisfaction. A policy statement should be developed expressing the commitment of the hospital to provide confidential help to workers having emotional, marital, family, financial, or drugs or alcohol abuse problems. Alcohol must be recognized as a disease responsive to treatment and rehabilitation. This policy should be endorsed by senior management.

The ability of the trained counsellors and accessibility of referral sources are an invaluable adjunct to the Occupational Health Service's initial relationship with the troubled worker.

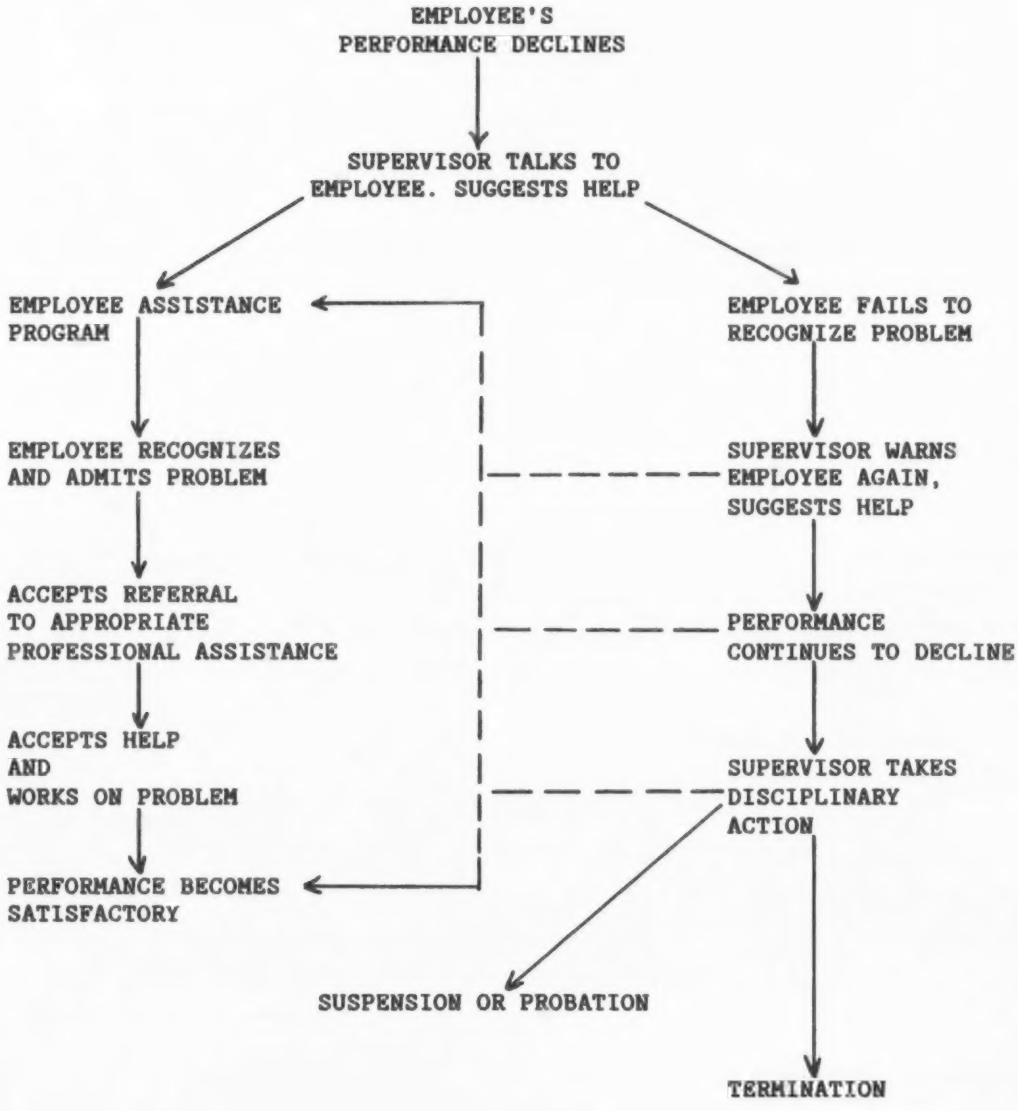
Through EAP, the Health Service is able to provide referrals for in-depth counselling geared to assisting the worker to resolve problems and restore productivity.

For the EAP to function it is necessary to devote a fair amount of time and effort in the training and education of supervisors. Several training sessions are usually necessary to familiarize the supervisory personnel with the signs and symptoms of the troubled worker and to provide them with the personal skills needed to approach the worker in a concerned and knowledgeable manner for referral and assistance. The broad range of assistance available is explained to supervisors. The EAP is often a very valuable extension of the immediate assistance provided by the occupational health department and builds on the role of counsellor which has always been part of occupational health nursing.

Within the of hospital, there is often a social worker or licensed psychologist available to co-ordinate the program. Published statistics indicate that a service of this type produces substantial savings as measured through decreased sickness and accident costs.

EMPLOYEE ASSISTANCE PROGRAM

THE SUPERVISOR'S ROLE


EMPLOYEE'S PERFORMANCE DECLINES
SUPERVISOR TALKS TO EMPLOYEE. SUGGESTS HELP
EMPLOYEE ASSISTANCE PROGRAM
EMPLOYEE FAILS TO RECOGNIZE PROBLEM
EMPLOYEE RECOGNIZES AND ADMITS PROBLEM
SUPERVISOR WARNS EMPLOYEE AGAIN, SUGGESTS HELP
ACCEPTS REFERRAL TO APPROPRIATE PROFESSIONAL ASSISTANCE
PERFORMANCE CONTINUES TO DECLINE
ACCEPTS HELP AND WORKS ON PROBLEM
SUPERVISOR TAKES DISCIPLINARY ACTION
PERFORMANCE BECOMES SATISFACTORY
SUSPENSION OR PROBATION
TERMINATION

Flow Sheet developed by Mary Johnson, Occupational Health Nurse,
Charles Camsell General Hospital

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Alberta Alcohol and Drug Abuse Commission. Quick Facts Pamphlets. Edmonton : AADAC, Program Development Division, 1979.

Canadian Labour Congress. A Plan of Action for Union Locals; Initiating a Joint-Management Employee Recovery Program at the Workplace. How and Why. Ottawa : C.L.C., 1980.

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Milstead; O'Keefe R.J. "Meeting the Needs of Working Women with Alcohol Problems," Labour-Management Alcoholism Journal, 10 (1980) : 50-69.

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Roman, R. "The Emphasis on Alcoholism in Employee Assistance Programming," Labour-Management Alcoholism Journal 8 (1979) : 186-191.

Roman, P. and H.M. Trice. "Alcohol Abuse and Work Organization," The Biology of Alcoholism. New York : Plenum Press, 1976, pp. 4, 445-517.

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XII. Video Display Terminals (VDT's)·

Video Display Terminals have five major use categories: word processors, computer terminals, data entry terminals, graphics terminals and micro computers. These models represent most of the VDT's in use in Alberta.

A. Health Concerns

These terminals have recently been tested by the professional hygiene staff of the Occupational Health & Safety Branch, Personnel Adminstration Office, using sensitive equipment recommended by the Radiation Health Branch of Alberta Workers' Health Safety and Compensation. In no case were x-rays or any other forms of ionizing radiation found to be produced by the electronic equipment.

The studies show that radiation levels, if any, are well below recommended safety standards. In the background at all time, there are different types of low level radiation from the surrounding environment; which as it has always been present and is accepted as normal and produces no ill effects.

Concern has been expressed about non-ionizing microwave and radio-frequency radiation. However, VDT's contain no parts capable of emitting microwaves, therefore, non-ionizing radiation has never been detected around VDT's. Small amounts of radio-frequency radiation is produced by VDT's and by electric kettles, and hair dryers. Levels measured are well below any safety standards.

In fact, the Radiation Protection Board of Health & Welfare states:

> "There is no reason for any person, male
> or female, young or old, pregnant or not,
> to be concerned health effects from VDT's."

B. Control of Hazards

1. Administrative Controls

Some people, particularly pregnant women, remain fearful. For these individuals, it may be possible to arrange for alternate work or leave of absence.

2. Engineering Controls

Other health concerns have been reported. Eye strain and muscular aches seem to be the most frequent. Before being leased or purchased, all new VDT equipment must comply with the Provincial Acts and Regulations, and with the requirements of the Canadian Standards Association.

To reduce the glare, the VDT should not face windows or bright lights. If a room has windows, the terminal should be in a position so that the operator's line of sight parallels the windows, or is away from the windows completely. The positioning of the VDT and use of drapes, partitions, or anti-glare filters are practical ways of reducing the glare.

The lighting should be designed to suit the majority of the operators in the work area. There should be subdued general lighting.

3. Personal Controls

The main causes of eye strains associated with the VDT screen are glare and the build-up of smoke, dust, and other deposits on the screen. The flicker effect and character brightness contributes to discomfort. Following the manufacturer's instructions, the deposit should be cleaned off of the screen regularly.

Light coloured clothing which will reflect on the screen is to be avoided.

To reduce eye strain, workers should close their eyes periodically or glance at a distance object from time to time.

Good posture and frequent breaks will assist in comfort in using VDT's.

There has been considerable misinformation generated about VDT's and these concerns should be discussed with the operators. Studies have been extensively carried out on VDT's and no physical hazards, other than the discomfort from the long periods of sitting, possibly in a strange position have been uncovered.

References

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XIII. Waste Management

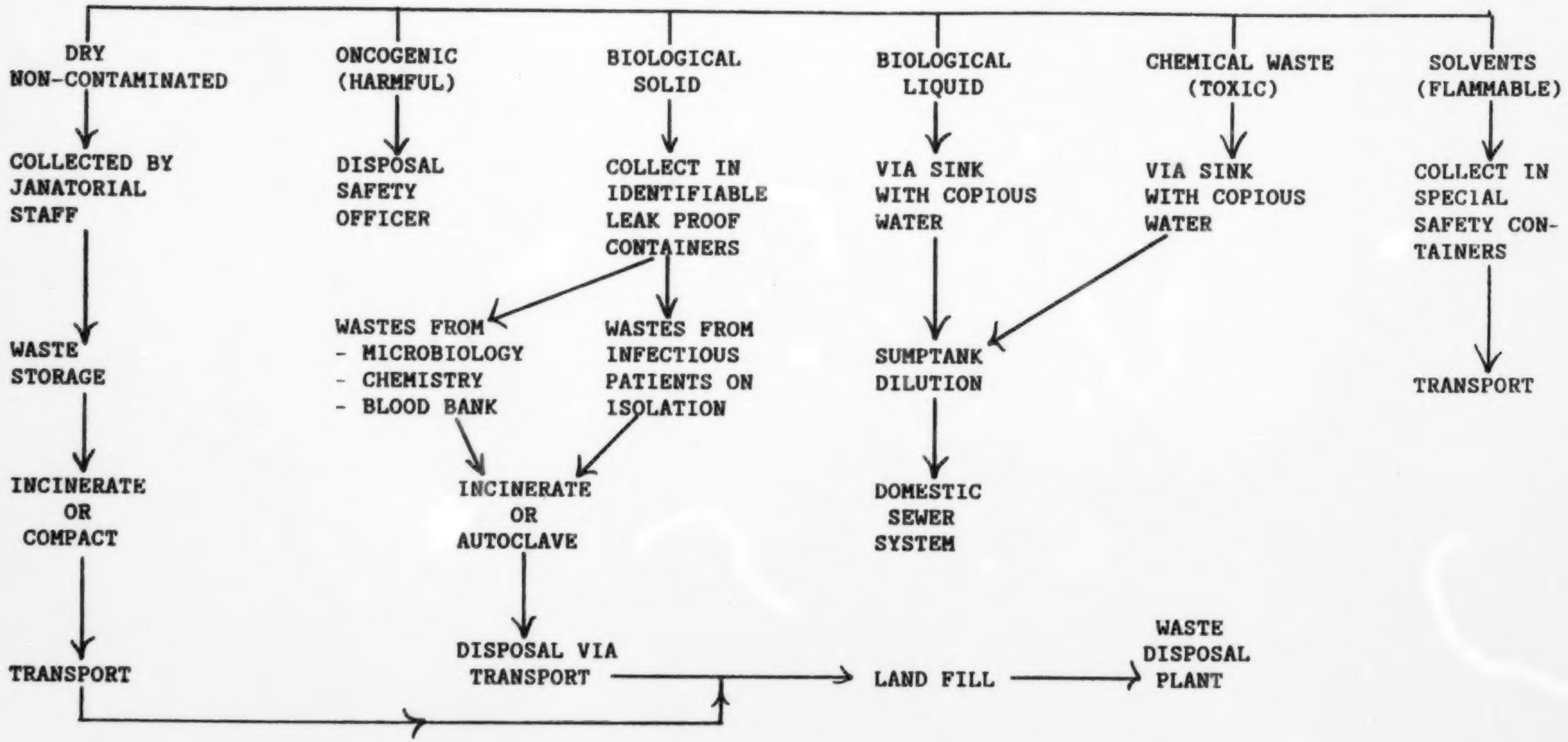
Hospital waste disposal methods are important in preserving staff and community health. Waste must be segregated and identified by type; colour coding of the garbage bags is a usual way. (Flow Chart page 3-124)

The different types of garbage are as follows:

- Dry, non-contaminated - the majority of this waste will ultimately be incinerated or compacted then transported to a land fill site or waste disposal plant.
- Oncogenic (harmful) waste to be disposed of by a safety officer.
- Solid biological waste (from infectious patients in isolation or waste from microbiology, blood banks, chemistry) to be put in special identified leak-proof containers and incinerated or autoclaved before being transported to a land fill site or a waste disposal plant.
- Liquid biological waste and toxic chemical waste is diluted with copious amounts of added water and disposed of through the sink into a sump tank with more water before being disposed of into the domestic sewer system.
- Flammable solvents are collected and put in special safety containers and collected for transport to a waste disposal plant.
- Radioactive wastes are removed by the hospital Radiation Protection Officer.

WASTE MANAGEMENT

Nature of Waste


DRY NON-CONTAMINATED
COLLECTED BY JANATORIAL STAFF
WASTE STORAGE
INCINERATE OR COMPACT
TRANSPORT
ONCOGENIC (HARMFUL)
DISPOSAL SAFETY OFFICER
BIOLOGICAL SOLID
COLLECT IN IDENTIFIABLE LEAK PROOF CONTAINERS
WASTES FROM
- MICROBIOLOGY
- CHEMISTRY
- BLOOD BANK
WASTES FROM INFECTIOUS PATIENTS ON ISOLATION
INCINERATE OR AUTOCLAVE
DISPOSAL VIA TRANSPORT
BIOLOGICAL LIQUID
VIA SINK WITH COPIOUS WATER
SUMPTANK DILUTION
DOMESTIC SEWER SYSTEM
CHEMICAL WASTE (TOXIC)
VIA SINK WITH COPIOUS WATER
SOLVENTS (FLAMMABLE)
COLLECT IN SPECIAL SAFETY CONTAINERS
TRANSPORT
LAND FILL
WASTE DISPOSAL PLANT

SOURCE: Infection Control Guideline Manual which was prepared by the Joint Committee on Infection Control of the Alberta Hospital Association and the Alberta Association and the Alberta Medical Association. September, 1983.